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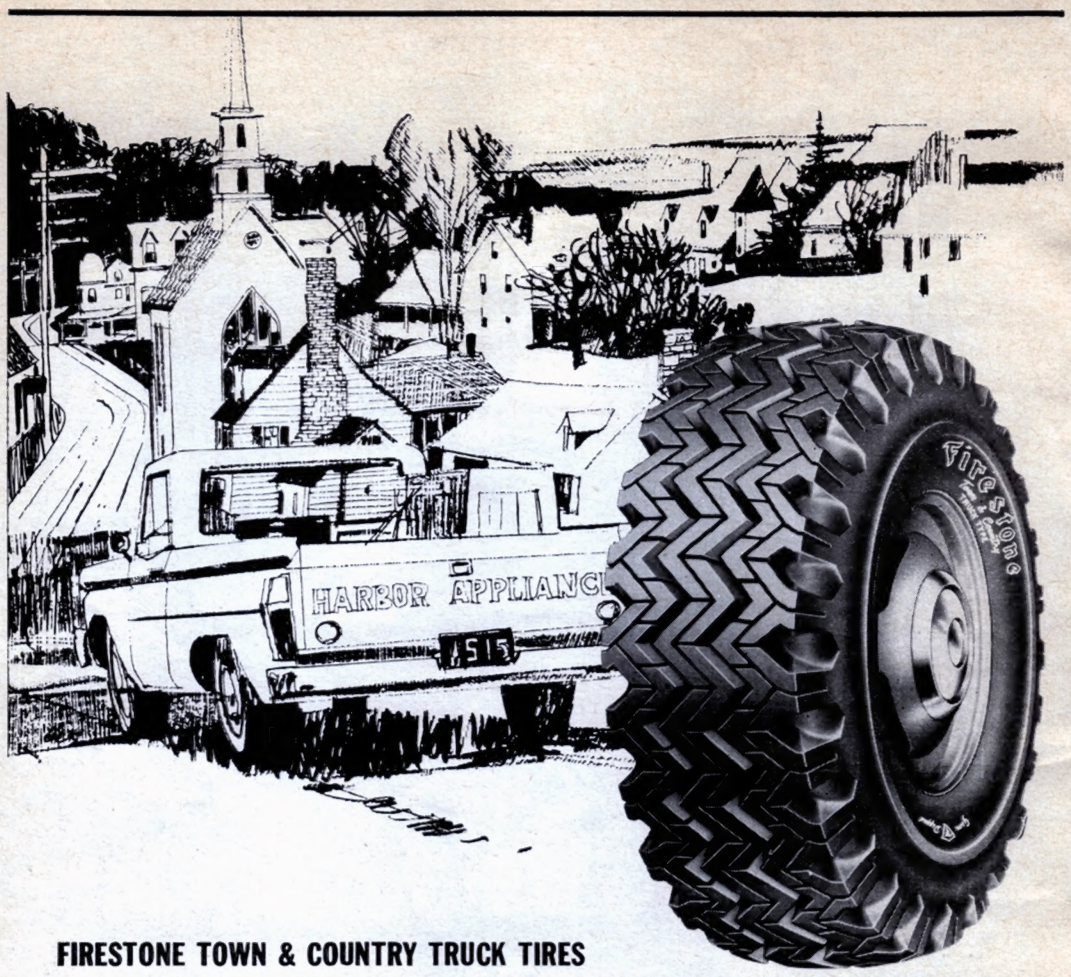

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VOL. 121 NO. 6

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Popular Mechanics is published monthly by **The Hearst Corporation**, 57th St. at 8th Ave., New York, N.Y. 10019, U.S.A. Richard E. Berlin, President; George Hearst, V-Pres.; Richard E. Deems, President of Magazines; Fred Lewis, Executive V-Pres. of Magazines; John R. Miller, V-Pres. and Gen. Mgr. of Magazines; G. Harry Chamberlaine, V-Pres. for Research and Marketing; William S. Campbell, V-Pres. and Director of Circulation; Joseph F. Kern, V-Pres. for **Popular Mechanics**; Frank Massi, Treasurer; R. F. McCauley, Sec'y. Single copy in the United States and Canada, 35 cents. Subscription prices: United States and Possessions, $4.00 for one year; $7.00 for two years; $10.00 for three years. Canada, add $0.50 for each year. Pan American Postal Union countries, add $1.00 for each year. All other countries, add $2.00 for each year. **When changing address, give old address as well as the new, with postal-zone number, if any, and allow six weeks for change to become effective.** Second-class postage paid at New York, N.Y., and at additional mailing offices. Authorized as second class mail by the Post Office Department, Ottawa, and for payment of postage in cash. Registered as Second Class matter at the Post Office at Mexico, D.F., Mexico, June 20, 1950.

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Over the Editor's Desk

Tree Medicine

I read with a great deal of interest your article *We Can Save Our Elms* (page 122, April *PM*). A more complete account of Dutch elm disease and its control would be hard to find even in the scientific journals. My compliments.

U.S. Naval Station, Washington, D.C. — RODERICK M. COAN, Entomologist

You mention that Bidrin is not available nationally and that it must be applied by trained personnel. I would like to know how I could introduce it into our area.

Dresden, Ohio — RAY K. DYE

"Bidrin will never be sold to the general public," writes J. J. Mauget, president of the J. J. Mauget Co. of South El Monte, Calif., which supplies the preventive for Dutch elm disease. "It will be handled exclusively through tree surgeons and other trained people.

"The material, being an organic phosphate, is highly toxic, and exact dosage rates must be administered to safeguard against phytotoxicity.

"Our program this spring will again be handled under the U.S. Department of Agriculture experimental regulations. Large-scale testing will be conducted this year in the following cities:

"Wisconsin: Madison and Milwaukee; Iowa: Bloomfield, Cedar Falls, Cedar Rapids, Davenport, Fairfield, Waterloo and Winfield; Kansas: Atchison, Garnett, Iola, Junction City, Lawrence, Leavenworth, Manhattan, Pittsburg, Topeka and Wichita.

"Local inquiries can be directed to the city forester of these cities."

Biblical Digging

I would like to congratulate you on *They're Digging Up Bible Stories* (page 110, April *PM*), describing archeologists' use of the Old Testament in modern investigation. There still are others who have never considered the Bible stories as myths or fairy tales. Yet we would pick a bone with the archeologists who regard the Jericho story recorded in Joshua 6:20 only as tradition because they say Jericho was destroyed before the Israelites invaded the land.

In the past, scientists have labeled the manna, the oil or pitch in Egypt, the Jordan River stopping and Moses getting

(Please turn to page 10)

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Over the Editor's Desk

(Continued from page 8)

water from a rock as tradition or as being untrue, but all of these things at present have been substantiated or found possible.

I suspect the Jericho story will yet be verified, for archeologists will admit that this city was located on more than one site over a number of centuries and that the date for the Israelite invasion is not well established. So they must admit that in this one instance—as well as in many others—they must yet argue from the position of ignorance or insufficient evidence.

Columbus City, Iowa — E. WAYNE RYAN, B.D.

Wrong Direction

In the air-turbulence story, *Unseen CAT Pilots Dread* (page 104, April *PM*) you incorrectly attribute the crash of a Northwest Orient Airlines Electra over Tell City in October 1959 to our airline. Northeast has never flown Electras and does not operate in that section of the country. The National Safety Council's most recent award went to Northeast Airlines for flying over 1,500,000 passengers a year in perfect safety.

Boston, Mass. — J. R. HANNAN, Northeast Airlines

The author correctly attributed the crash to Northwest, and our editors left it that way. But in re-setting a damaged plate, a typesetter goofed on two crucial letters. It was, indeed, a Northwest Orient plane that crashed.

Likes the Boats

I find *PM* to be excellent and very informative. I consider your boat designs to be some of the very best and a great help to people of modest means.

Jacksonville, Fla. — AUSTIN B. ADKINS, JR.

Good Start for the Fireman

We noted with some satisfaction that Dick Radatz, relief pitcher for the Boston Red Sox, got the year under way in fine style by winning the season's opener as a reliefer against the New York Yankees. Radatz told in our May issue (Fireman, Save My Game, *page 90) how he and other late-inning artists save games.*

We'd like to point out that it was Tom Wells of Cincinnati, Ohio, who suggested the story to us—and did a dandy job of gathering information, interviewing top "firemen," and helping Radatz put the yarn together.

The Editor

4 reasons why you'll benefit from this 30-second "Push-Pull" exercise

1. 2.

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2. SAVES DECISIONS. One-eyed cars call for one-man decisions. Quickly now: Which light is out? Or is it a motorcycle? Can you get by? Time's up! Now you know how the other guy feels when the one-eyed car is yours.

3. 4.

3. SAVES TRIPS. Burned-out lamps cause 60% of all rejects at vehicle safety checks. Take 30 seconds to check your lights or have 'em checked *before* inspection. Why make two trips to earn your safety sticker?

4. SAVES MONEY. A burned-out tail light, headlamp or turn indicator can signal a cruiser. When you break the law you invite a warning or even a ticket—to make it an expensive trip.

The exercise:

PUSH THE BRAKE PULL THE SWITCH

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OR, if you shun exercise, have 'em checked where you normally have your car serviced. Got a burnout? Now exercise your *choice*. Ask for dependable G-E lamps, the brand most people prefer. General Electric Co., Miniature Lamp Department, M-50, Nela Park, Cleveland, Ohio 44112.

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Sidelights from the SERVICES

By William R. Kreh

A medieval trick may become a modern weapon. The Army is testing a catapult device that's capable of hurling 50-gallon drums of jellied gasoline, white phosphorus or other incendiary material at enemy troops. The catapult uses an explosive cartridge to drive a piston which, in turn, actuates an ingenious linkage that controls the device's pitching arm. Capable of hurling a bomb or package of 350 pounds about 450 feet horizontally or about 200 feet up in the air, the device could also be used to deliver packaged stores or ammunition to friendly units. The catapult weighs only 850 pounds. It folds quickly and automatically into a mobile container that can be towed by a jeep or light truck.

Torpedoes away! Torpedoes dropped from submarines in the same way that bombs are from airplanes may be on the way. The Navy is studying a system in which a shark-shaped torpedo is dropped through a "bomb bay" in the bottom of a submarine's pressure hull. Gravity pulls the finned weapon clear of the sub and then the weapon's power plant starts it moving toward an enemy target.

Dressed in metal skins, Army missiles use something like milady's girdle to make sure everything stays arranged inside. Missile scientists use elastomer, an elastic product with a rubberlike base, as a binder in the solid-propellant rocket motors. Now the scientists are looking into the use of elastomers of fiberglas composition as a material for building the outside skin of a missile.

An underwater speedometer so sensitive that it can measure speeds of sea currents ranging from 20 knots to one that travels only one mile in 3½ days has been developed for the Navy.

Yards to go. Navy fighter planes are being equipped with a device which shows a pilot the exact number of "yards to touchdown." The indicator tells precisely how far a landing jet has to go until its wheels touch down on the deck of an aircraft carrier. It's accurate from 8000 yards.

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A scratching dog turned out to be a remote control for a California television set. The set jumped wildly from channel to channel. The baffled family became even more baffled when they noticed that the station-switching happened only when their dog was scratching.

To the TV expert it was a new switch on an old story. The remote control for switching channels on this set worked by means of a tuning fork inside the set. An accidental sound with just the right pitch will be picked up by the tuning fork and cause the channel switch. Sometimes a phone ring or the jangling of keys will do the trick.

In this case, the jingle of the dog's license tag as he scratched in the living room sounded a note of just the right frequency to activate the control.

How sensitive can you get? Space scientists have developed an electronic device so sensitive it can detect $\frac{1}{100}$th of the impact of a grain of salt falling three-eighths of an inch. The ultra-sensitive electronic sensor was developed to measure the impact of tiny micro-meteorites on spacecraft.

Explosions on the sun, which blank out long-distance communications here on earth and shoot streams of cosmic rays at us, may be better understood soon as a result of a giant instrument called a heliograph that's being constructed in Australia. It will consist of 96 round receiving antennas, each 44 feet in diameter, arranged in a circle about two miles across. They will take pictures of the sun as it is revealed by the radio waves it emits. The object is to find some way of predicting these explosions. We could then brace ourselves against onslaughts of communications troubles and keep astronauts out of the way of the heavy solar cosmic rays.

For cat eyes, eat bilberries. They are something like huckleberries and grow profusely in southern France. British fighter pilots were once reported to eat bilberry jam before going on night missions. Russian cosmonauts are said to eat it before rocket flights. French researchers say they have extracted from the bilberry a chemical that adds rhodopsin, a light-sensitive pigment, to the eye's retina. Pills made from this chemical are reported to make night driving easier, and to help hunters shooting at twilight.

Can a frog see? You'd think he must, since he will jump and catch a flying insect. Yet if you surround him with dead insects on the ground, and none in the air, he will starve to death. Apparently he doesn't see them. Experiments show that he can see objects against a light background only. And in traveling, he has a strong tendency to jump toward blue light. A British scientist, discovering this fact, theorizes that the jump toward blue takes him to water and safety—there being more blue in the light coming from water.

Insanity, according to the ancients, was caused by the moon. Our word lunatic (meaning moonstruck) is a monument to that belief. Now it seems the old timers were blaming the wrong heavenly body, and the sun is the real villain. New York psychiatrists checked day-by-day admissions to mental hospitals and clinics for four years. They compared these to figures gathered by the Coast and Geodetic Survey on disturbances on the earth's magnetic field caused by the sun. The results indicate that when the magnetic field is disturbed, people are disturbed, too.

Help is here for harried secretaries whose shorthand lags behind space technology. The National Space Agency has come up with shorthand symbols for 3,000 aerospace terms, such as aberration and zero gravity, based on the Gregg system.

Propeller damage, even a small nick or dent, can cut down on the efficiency of a ship. So can barnacles growing on the hull and a hundred other things. But in constantly changing conditions of winds and waves and weight of cargo, it's hard for a ship's captain to tell how much efficiency he has lost, much less what's causing it. Shell International Marine believes it is whipping this problem with electric computers and radios. Shipboard data is collected by meters installed aboard a ship—data on speed, weather, engine temperatures, fuel consumption and the like—and radioed to a computer center in London. The computer, analyzing the figures, can often spot damage or malfunc-

(Please turn to page 17)

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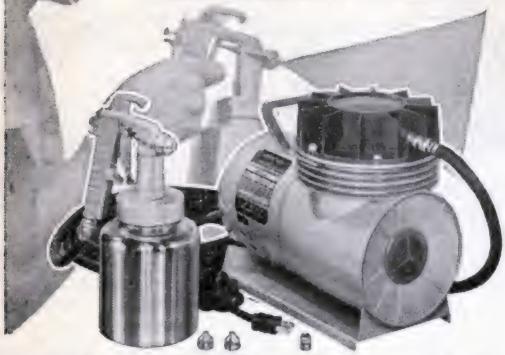

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CORVAIR MONZA SPYDER by CHEVROLET CHEVROLET

Science Worldwide

(Continued from page 14)

tioning parts and this information is radioed back to the ship so it can be repaired.

A bald-headed doctor at a Veterans Administration Hospital noticed a curious fact: He had never seen a bald man with lung cancer. With a colleague, he made a systematic two-year search among lung cancer victims and other patients. Sure enough, the figures bore out the doctor's original impression—lung cancer appears to be comparatively rare among the bald. On the other hand, the skinheads had more than their share of heart disease.

Milk without grass is being produced by a Finnish experimenter. He does it by feeding cows material containing bacteria which can convert starch or sugar into protein. This permits cows to thrive and produce good quality milk on a diet without grass or protein. But to do this, old sukey had to be supplied with flavored cellulose strips or straw to chew as a cud.

Clear pictures in muddy water—that's what comes of a new camera made for examining submerged structures in London harbor. Camera and flash are mounted at the back of a water-tight box, which is almost cubical and about two feet deep. The camera is focused on the clear plastic front of the box, and the box is full of clear water. A diver takes it down, pushes its front against the object he wants a photo of, and there's no muddy water between the camera and the object. Why is the box full of water? Because it'd be too buoyant for a diver otherwise.

A monkey hooked on morphine acts very much like a human hooked on morphine. If he gets his shot on time, he seems to enjoy life; if not, he is a sick monkey. Monkey addiction has been made as nearly as possible like human addiction by a highly complicated mechanism constructed at the University of Michigan. It consists of a needle buried in a monkey's vein, attached so that it won't come out or wound him, yet at the same time attached to a supply of morphine. Touching a special pedal in the cage causes the needle to discharge a drop of "dope." The experimenters give him the first few shots to give him the habit. He soon catches on about the pedal, calling his own shots. And you've got an addict.

John P. McNeel
Science Editor

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DETROIT LISTENING POST

By Jim Whipple

Ford's after Plymouth with a 7000-RPM Engine. New Formula S Saab Racer Will Top 100 MPH

It's a seesaw year for stock racing cars. First off, the **Ford** partisans got shook up when Plymouths with **Chrysler** Corporation's new "hemi" engines blew them off one, two, three at the big Daytona 500.

Now it's **Ford's** turn once again. After the sting of the Daytona shoo-in by **Plymouth, Ford** factory engineers reached deep down into their golden parts bin and came up with "the Seven Grand" engine. Still the sanctioned 427-cubic-inch, push-rod valved V8, the "7-G" was so named because its power peak has been moved up to 7000 r.p.m. while the gear ratio was dropped slightly. This permits more power strokes per mile, enabling the same displacement engine to drive the car just that much faster.

In short, it's time to rewrite the old hot rodder's saying that "nothing beats cubic inches!" Something does—cubic inches **plus** r.p.m.s!

The proof of the pudding is in the racing. As we went to press, Ford's 7-G engine came in with a First and Third place in the Atlanta 500, setting a new average speed record—134.25 m.p.h. for 500 miles.

It's also been heard around that the **Fords** have been lightened by judicious removal of some extra iron that added up to a 400-plus pound penalty **Plymouths** didn't have to carry.

Holman and Moody (the "when-faster-**Fords**-are-built, **we'll-build-'em!**" boys) have been playing around with a 427-cubic-inch Galaxie engine shoehorned into a **Fairlane.** It adds up to giant power in a package a bit lighter, and with slightly smaller frontal area than a **Plymouth.**

As of the moment we hear that John Holman is having a bit of a problem persuading NASCAR prexy Bill France that his "FairGal" is, strictly speaking, a "stock" stock car.

This sort of thing is lots of fun and reminds us of an old Army buddy who somehow squeezed an OX5 Hispano-Suiza V8 under the hood of a '32 **Ford** two-door. This engine's original home was an Air Corps JN-4, "Jenny," training plane and it pulled 200 bhp. to the **Ford** "Deuce" V8's stock 65. It also piled an additional 400-500 pounds onto the little **Ford's** front end. My friend made this brutal engine swap at the request of THE patrolman in a small Ohio college town, who was being humiliated by losing nightly chases after college boys who drove newer and hotter **Fords, Buicks** and the like.

The "Hisso-ized" **Ford** brought about a dramatic change in the driving habits of the students, relates my friend, until one night the cop became so engrossed in chasing a big LaSalle that he misjudged a sudden curve at the end of the long straight road leading from town.

The Old Ford's steering lost a brief battle with the immutable laws of physics and the "Enforcer" made a 90-m.p.h. trip through a cornfield, trailing barbed wire and fence posts like so many paper streamers. "A corn crib slowed him down some," recollected my friend, "and he finally 'spun out' in a manure pile."

The moral of this grievous tale, is of course: "Don't start what you can't stop."

Someone may be chasing Formula V racers (*PM*, May 1964 page 98) soon when Quantum Motorcar Corp. of New Haven, Conn. gets into production with its **Formula S.** The S stands for **Saab,** the Swedish economy car which forms the basis of the single seat race car just as VW engine and running gear formed the basis for the **Formula Vs.**

The three-cylinder, two-cycle **Saab** engine, which drives the front wheels of the passenger car, will be moved amidships in the racer and drive the rear wheels. A complete kit including fiberglas body and all parts necessary to make a **Formula S** race car from a stock **Saab** passenger car will sell for approximately $1100. For an additional $380, a tuned 65 horsepower **Saab** engine will be available on an exchange basis. This engine, claims Quantum's president Henry Rudkin, Jr., will power the **Formula S** to over 100 m.p.h.

According to a Bendix spokesman, front disk brakes in combination with non-energizing rear drum brakes and a simple single stage vacuum power unit could be offered as an option if manufactured in moderate quantity, for about $55. This compares with the current cost of a power brake unit of about $38.

These tires protect your fun with Nylon!

Now, Goodyear Super Rib boat trailer tires (4-ply rating and above) are made with 3-T *Nylon* cord—triple-toughened for extra strength and stamina. That's why they take murderous poundings under heavy loads far better than ordinary tires.

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Sidelights on AVIATION

Reducing diets may seem unusual subject matter for an aviation column, but they logically follow a story *Popular Mechanics* ran last month on how Air Force medics are testing ways to tell exactly how much fat a man is carrying, right down to the gram. Some readers asked, "So you can tell how much fat a man has. So now what do we do about it?" Well, here are a few suggestions.

Dr. Thomas Allen, who designed the water tank used in one of the experiments to measure the volume of a man's body (and compare his volume to his weight), feels that three normal meals a day, with no nibbling in between, is the best goal to aim at. But even overeating at meals may store up unnecessary fat.

Further than that, he suggests that after 28 a man cut out desserts to maintain his body weight. If he's still gaining, then cut out something else—and alcohol is a good place to start. If he's still putting it on, then go see a doctor and establish a workable diet to suit his own needs.

In another Air Force experiment, selected airmen were put on a carefully selected—and extremely rigid—diet that guaranteed them the loss of a half pound a day, or 30 pounds in 60 days.

For breakfast, they ate one egg and six ounces of skim milk. For lunch, a tossed salad with vinegar, salt and pepper. For dinner, three ounces of lean meat and more tossed salad.

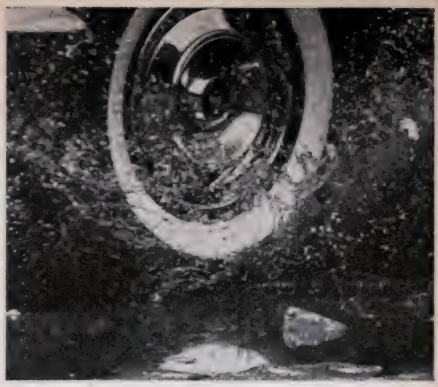
Sounds rough, but some concessions were made. Tea and coffee, without cream or sugar, were allowed in unlimited quantities. And, at cocktail time, one highball with water or soda, was the rule.

These men were under rigid supervision, however, and anyone else had better check his doctor before trying this stringent diet.

Meanwhile, out at sea, the Navy has its own ideas on diet. Basically, it suggests sticking to God-made foods (meat, vegetables and fruits) and avoiding man-made foods (hot rolls, butter, gravy, ice cream and pie). It also suggests avoiding potatoes and nuts, and it frowns on drugs. They may spoil your appetite for a while, but sooner or later you'll have to go out on your own. Happy eating!

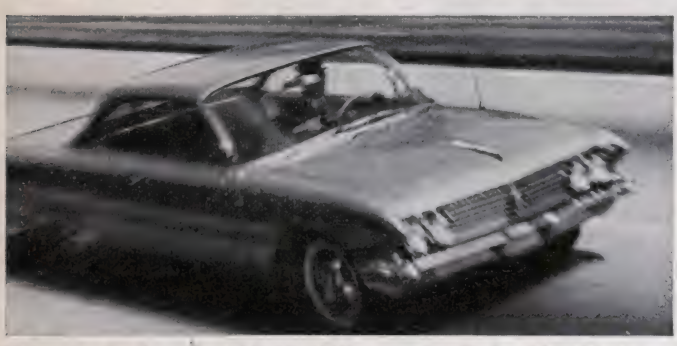
Kevin V. Brown
Aviation Editor

new MONROE front Load-Leveler stabilizing units



Hold the road firmly with the added stability of front Load-Levelers. Prevent spine-jarring, "bottoming" on bumps that wears out tires, damages front end parts, reduces car control.

extend front tire life as much as 50%



No more wheel wander at top turnpike speeds with front Load-Levelers providing added control. No more side sway in high crosswinds or when heavy vehicles pass. You'll be amazed at the remarkable difference. Front Load-Levelers will give your car a sure-footed sports-car feel.

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60-Day Free Trial. Nothing we can say about front Load-Levelers can be as convincing as your own experience. Have a set installed where you have your car serviced. If after 60 days you don't agree front Load-Levelers deliver the ride you want, return them for a refund and reinstallation of your old shocks. Keep them, and satisfaction is guaranteed for at least 30,000 miles of safer, more pleasurable driving.

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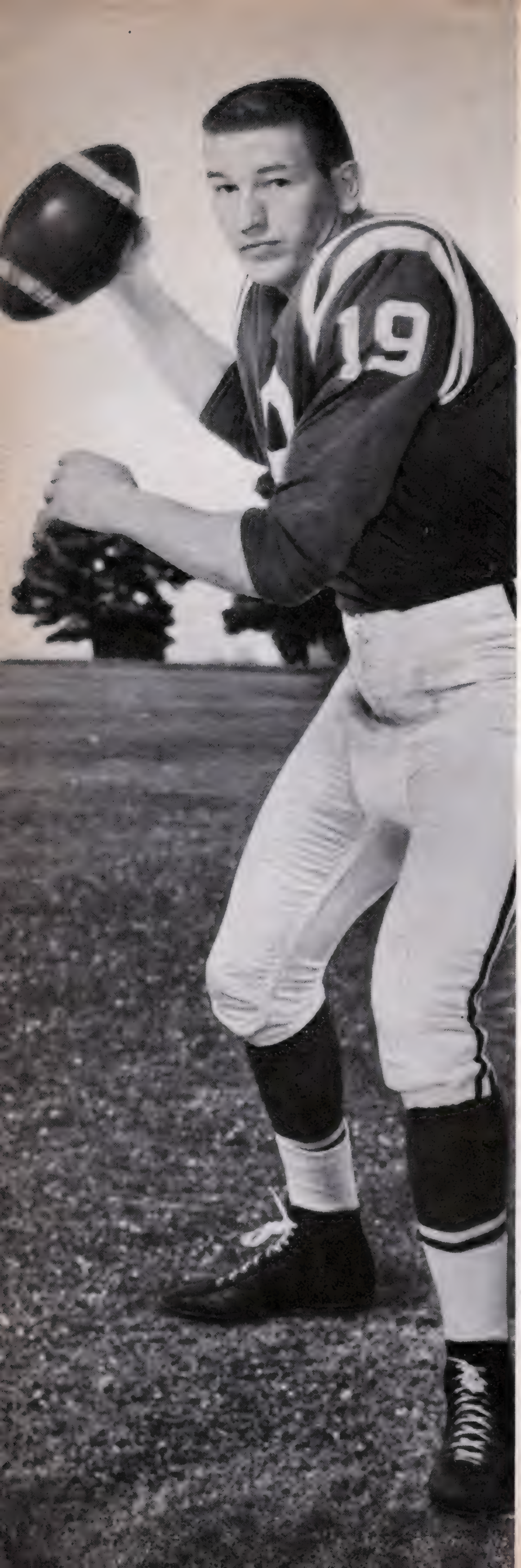
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INVENTORS' CORNER

By Joseph H. Kraus

Mr. Kraus has been helping inventors solve their problems since 1919. Readers may send queries on ideas, inventions and patents to him, care of *Popular Mechanics*. Questions of general interest will be answered in this column. Please include all information necessary to understand the proposed idea or invention, plus your return address.

Smoking golf ball is proposed by E. C. Kaplan of Worcester, Mass. He reports he was informed that it "costs a lot of money" for a search. Could he sell the right to his invention to a manufacturer?

Only if you can locate one foolish enough to buy what you do not know is your property to sell. The average search will cost from $15 to $25, if performed by a patent attorney; less than half as much if done by a patent searcher. The former will advise you, too; the latter will not. In your design you destroy completely every good quality of a golf ball. A chemical liquid could provide smoke without changing the ball or its flight characteristics.

Tailless kites with superior flying characteristics might provide commercial possibilities, says Robert G. Vaughn of Greensboro, N. C. Should a patent be obtained? Is further development worthwhile?

Your "interesting experiment" cannot be supported. The tailless kite invented in 1890 by William A. Eddy, of Bayonne, N.J., and the thousands of tailless kites designed and flown by the Chinese, Japanese, Koreans, Malays, Maoris, etc., some dating back to several hundred years B.C., will blast holes in your findings. It seems doubtful that you could win a patent on your design which appears to be a slight modification of a simple stick glider. A study of what has been done before might lead to something modestly saleable.

An idea factory is a mental exercise developed by Kenneth Spatz, Adamstown,, Pa., and his two sons. A surprising number of practical ideas have come out of these sessions. Would it be advisable to contact different companies, furnish details and models of these ideas and inquire if they are interested?

No! Such a disclosure would give you a year in which to file for a patent. Make that electric hot rod model, test it, iron out the bugs, then seek a patent search through a registered patent attorney. Follow with a patent if you are sure of the values. Now you have a legal right to a piece of property which you can sell or license. Regardless of the outcome, we congratulate you on inspiring your sons to stretch their imaginations.

A magnetic motor designed by Gill M. Rutherford of South Fort George, B.C., Canada, does not seem to work when built. He says he may not be a good enough mechanic to make it operate. Or maybe there is some logical principle which he has overlooked?

If you supply sufficient electrical energy to a properly constructed unit, you should get it to operate. You then will obtain vibration and nothing more. Attach a weight off center to the shaft of any motor and you get the same thing. Why complicate it?

NEW PATENTS

Human bones can be grafted together with a new "paste" made from the bones and tissues of calves, according to patent 3,126,884 granted to Dr. Eli Jordan Tucker Jr., of Houston, Tex. The substance preserves live animal tissue so that it will stimulate new bone growth when transplanted into human hosts. It is also said to prevent malignant tumors from growing back once they're removed.

Non-greasy potato chips with a low caloric value can be achieved by boiling hexane under the cooking potatoes. Vapors pass through the chips, condense and drip back down to the hexane container, removing the oil in the process, according to patent 3,127,271, granted to Arthur B. Goulston of Cambridge, Mass.

Sunken wrecks can be salvaged with a new diving bell or pontoon described in patent 3,123,036 granted to Leif Lih, Brooklyn, N. Y. The lift is adjustable to any lifting speed or weight and can pull objects from the bottom silt.

A new fish scaler and cleaner permits "on-the-job" cleaning. You merely slit the fish open along the stomach and place it in a hollow, cylindrical mesh drum trailing in the water behind your boat.

The prop wash rotates the drum, creating a vacuum which guts the fish. Sharp projections inside the drum remove the scales. It won patent 3,095,601 for Harvey J. Wier, Sr., of Opelousas, La.

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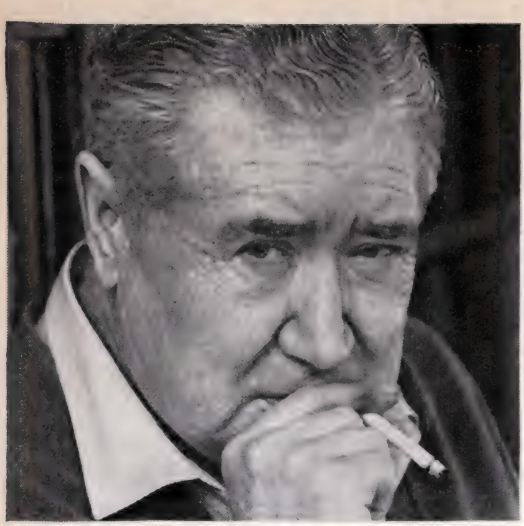

"YOU'LL NEVER SEE ME DOING THIS AGAIN," says Reynolds. Photograph was taken a few months before the author gave up smoking.

It's hard for a writer to GIVE UP SMOKING

Here's how I cut from 4 packs to 0 in 5 days

by QUENTIN REYNOLDS

A SURGEON can't very well operate with a cigarette hanging out of his mouth. When counsel addresses the jury, he doesn't stop for an occasional puff. But it's easy for a writer to smoke at his typewriter. In fact, I'd say that excessive smoking may well be one of the peculiarities of the craft.

I know that I smoked for thirty years—4 or 5 packs a day. I didn't think there was any easy way to stop. Then something happened!

Some time ago I was flying to Louisville with a few friends. A horse called Chateaugay was about to surprise us by walking away with the Derby. In the group was a friend of mine who doubles as my doctor. After listening to me hold forth for about twenty minutes on why Candy Spots was a shoo in, he said, "Quent, what's the matter with your voice?" I realized then that for some time I had been getting more and more hoarse and gravelly. "I'm going to have a look at that throat when we get back to New York," said the doctor.

A few days later I heard his verdict. "That throat of yours is as red as a maraschino cherry," he told me. "No more smoking for you!"

I dare say thousands have faced the same problem, but I still say it's harder for a writer to give up smoking than for anyone else. Fortunately, I have a secretary who is notably resourceful. She had heard about a little white pill called Bantron which has helped people all over the world to stop smoking. She got me a box. And in just 5 days, taking one of these little pills after every meal, I gave up smoking entirely.

I had absolutely no withdrawal pangs. Stopping was easier than I ever expected. Bantron didn't affect my taste in any way. It didn't even make me dislike smoking. It just removed the craving. I was so impressed that I became a kind of crusader. I wanted everybody who needed to stop smoking to hear about Bantron. I made some inquiries and found that it had an interesting, even dramatic, background.

The Bantron formula was discovered by doctors in the research department of a great American university. Its active ingredient is lobeline sulphate, a first cousin to nicotine, mimicking its action without being habit forming. The lobeline acts by displacing the nicotine in the system and helps curb the desire for tobacco.

So startling were the first results obtained with this little pill that further investigation was carried on. For months the research team carefully tested it on hundreds of people. The results showed that 83%—more than 4 out of 5 of all people who wanted to stop smoking—did so easily and pleasantly in five to seven days with its help. Even those who didn't stop completely had drastically cut down.

Bantron was granted a patent by the United States Government, and The Campana Corporation of Batavia, Illinois was chosen to market it.

Because of what it did for me, I am a firm believer in Bantron. If you have a smoking problem, try this amazing little pill. It really works! Bantron® is so safe when taken as directed, that you can get it in the United States and Canada at all drug stores without a prescription.

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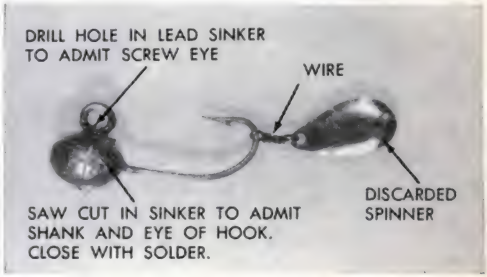
Items from All Outdoors

Forty-seven years of fishing can give a man some strong opinions, but it can also teach a man some things that are worth listening to. For the past two years we've been listening to Matt Mattfeldt of Atlanta, Ga., and here are a few things he feels strongly about:

1. Movement is the most important thing in a fishing lure. Fishermen will go in for all sorts of expensive hardware, but the cheapest little lure will do the trick if the movement is attractive to the fish.
2. Don't buy specific lures, buy types. The four best all-around lures are the floater, the flasher, the weedless and the bottom bouncer.
3. You can always catch more fish from a boat. And when you're fishing look for weeds—the fish do.
4. Ordinary duck feathers make a fine lure. Dye them yellow with water and picric acid, and tie them back-to-back to the shank of the hook. When trolled very slowly it will resemble a live shrimp.
5. The best all-around lure is the Upperman bucktail jig. It has taken over 100 species of fish, and was the only lure issued in Navy survival kits in WW II.
6. For really economical fishing you can catch anything with a No. 10 forged hook and a chamois streamer cut in the shape of a minnow no more than one inch long. Use a fly rod. Let the lure sink deep and retrieve in jerks. Total cost is about one-half a cent.
7. All salt-water fish will bite on a simple white hair streamer.

Matt makes most of his own lures, with this spinner-type jig his favorite.



As we said before, this is one opinionated fisherman's opinion. We'll now hear a hundred more opinions, but that's fishing.

STUART JAMES
Outdoors Editor

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CLINIC FOR HOMEOWNERS

Q Will you explain why moisture usually is no problem in older homes, but is a cause of damage and inconvenience in homes of more modern construction?—H. S., Kansas.

A That moisture problem again! Space does not permit an extended discussion of causes but perhaps a brief outline will help. Warm, moist air normally seeks, or flows toward, cooler, drier air. Because of what is known as vapor pressure, moisture escapes through walls and ceilings of older homes—those having uninsulated walls, or both ceilings and walls—when the outside temperature is lower than that inside the structure. Water vapor will pass through any porous building material. Due to the greater heat loss through walls of older, uninsulated structures, the moisture in the air passing through the walls and cracks is not cooled to the dew-point and no condensate forms in the walls, on the room side of walls or elsewhere, except possibly during severely cold weather, and then mostly on window panes, the glass being non-porous. When, some years ago, insulation not having a vapor barrier was installed it had the effect of slowing the passage of the warm moisture-laden air through the walls and ceilings with the result that at some point within the walls the moisure (water vapor) was cooled to the dew point and condensate formed on exposed surfaces. This slowing of the heat loss also permits condensate to build in greater quantity on non-porous surfaces, such as the window panes. When a vapor barrier of any non-porous material is placed on the room side of the walls and ceilings over the insulating material, the vapor is retained at or near room temperature and no condensate forms, except possibly in severe weather on single-pane window sash unprotected by tightly fitting storm sash. Double-paned windows rarely give trouble as the inner pane is usually at or near room temperature.

Water vapor in the air of a home can be appreciably lowered simply by avoiding running excessively hot water, reducing the boiling of water in food preparation to the minimum, reducing output of furnace humidifiers, installing kitchen and bathroom ventilating fans, making

certain that your automatic gas clothes dryer is properly vented and, in some instances, installing a duct to bring cool, dry air from the outside to the forced-air furnace. Whether this is advisable must be determined by a competent heating engineer. It is not, of course, permissible in all types of forced-air heating installations.

Q I've purchased a very old brick two-story home having two chimneys built into the walls. One extends down to the first floor, the other ends at the second floor with an opening in the wall about 5 in. in diameter. Can I use the longer flue for a fireplace?—N. S., Pa.

A We don't know. You didn't give the sectional size of the longer flue. Undoubtedly these chimneys originally vented wood-burning stoves and very likely neither flue is of sufficient size to properly vent a conventional fireplace. However, if a careful check of the longer flue shows it to be of required size—usually 6 x 12 in., or 6 x 14 or 16 in. minimum, depending on size of the fire opening—then it may be possible to utilize the longer of the two for your fireplace, provided, of course, the brickwork is still in good condition. This is a job for your mason contractor. He's in a better position to advise than are we.

Q I want to soundproof a room ceiling to deaden sounds from above. I'm told acoustical tile will not be effective, that I'll have to double the ceiling and install conventional soundproofing. Or will I? Is there any other way?—U. K., Wash.

A It's probably true that acoustical tile will not prove as effective in deadening sound from above, although there will, of course, be some effect. We'd suggest you consider installing a drop ceiling, with a space of a foot or so between the drop and the true ceiling. The necessary metal hangers and Tees and also acoustical panels are readily available and are comparatively easy to install. Although this still is only partial soundproofing and "upside down," as it were, we believe you will find it fairly effective.

As a service to Popular Mechanics readers in solving the hundreds of problems pertaining to a home—inside or out—you are invited to present your problems to The Clinic Editor for his helpful advice. Address your questions to The Clinic Editor, Popular Mechanics Magazine, 575 Lexington Ave., New York, N.Y. 10022

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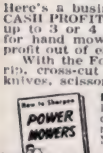

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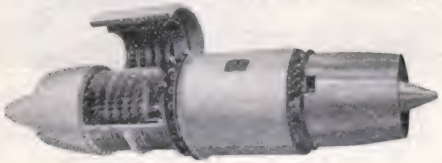

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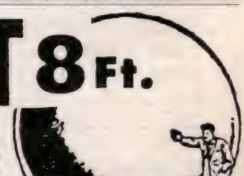

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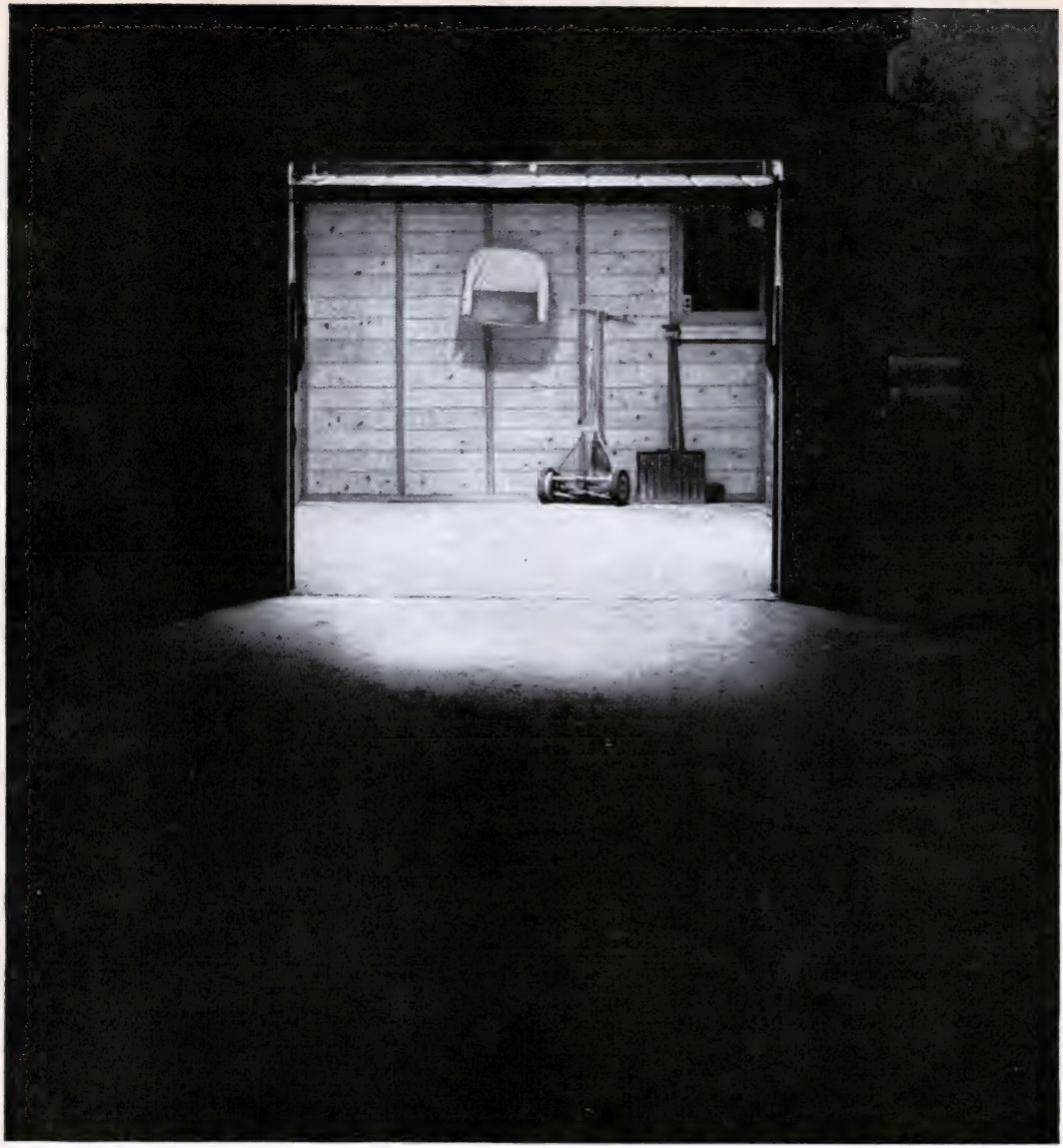

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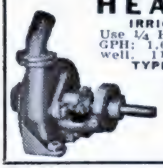

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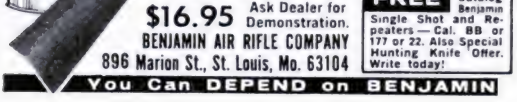

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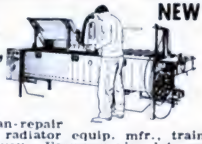

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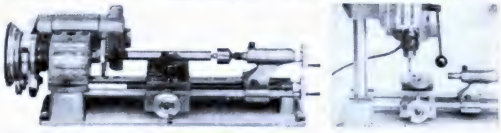

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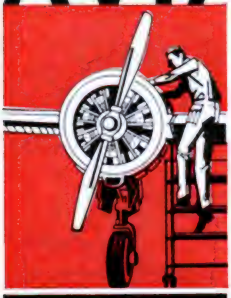

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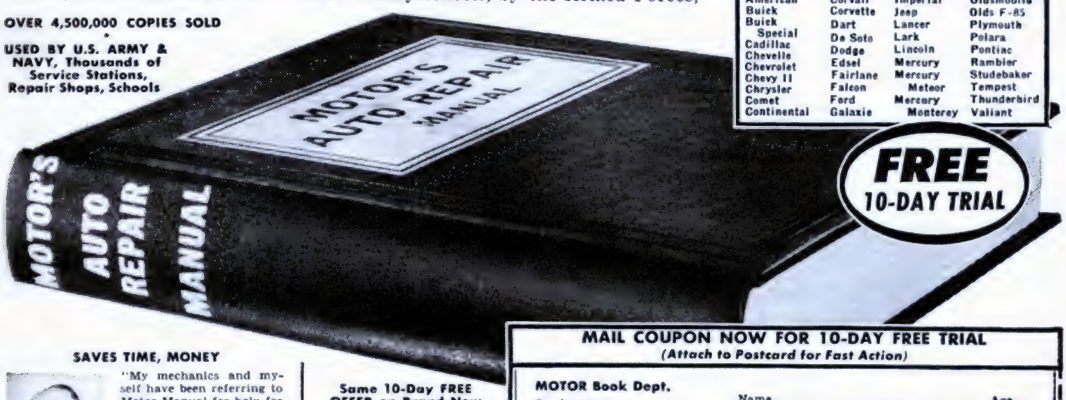

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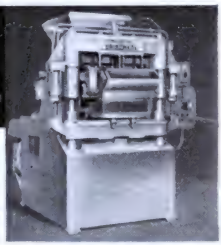

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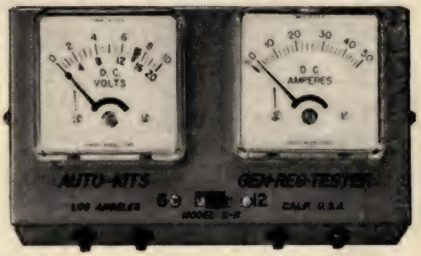

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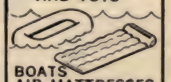

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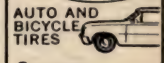

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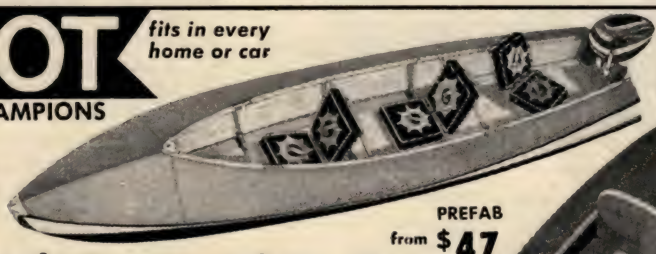

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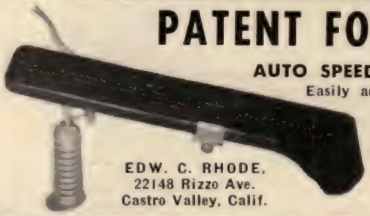

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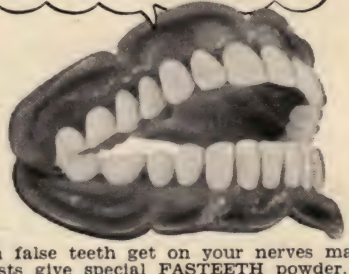

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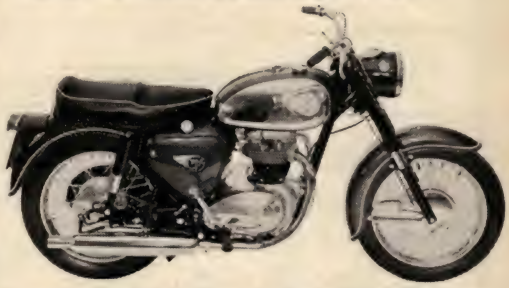

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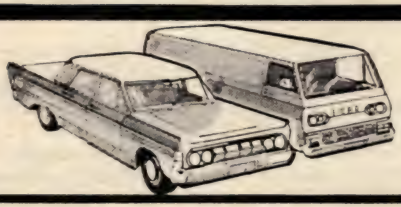

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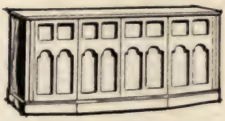

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Yet, the toughness you need is there, too. Axles, frames, springs and cab are heavily constructed with big-truck design for big-truck durability. The all-welded cab is solid and quiet. New double side-wall Styleside box is the strongest ever. Take a test drive today —see how comfortable a tough truck can be!

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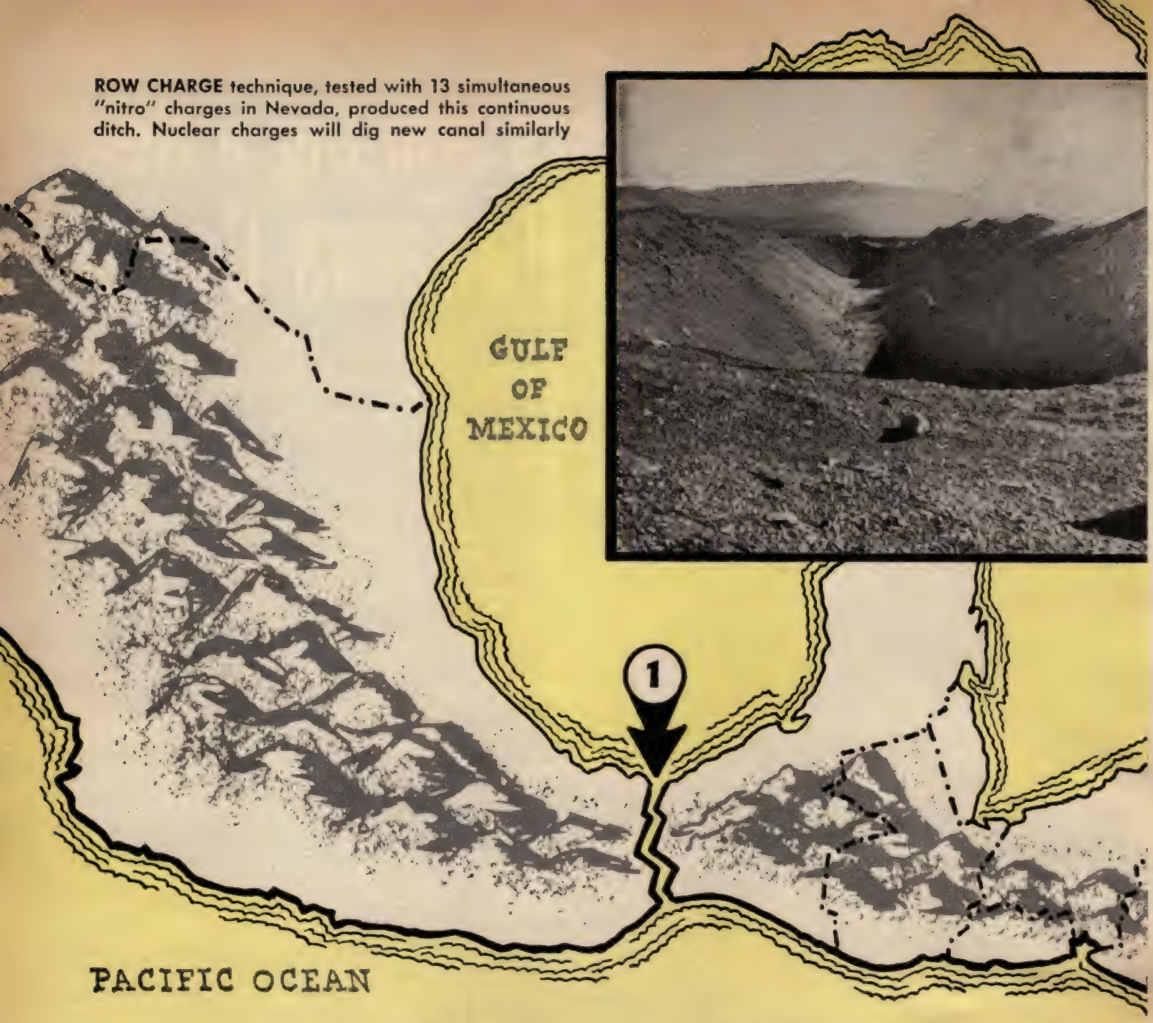
POPULAR MECHANICS
June • 1964

How Nuclear Blasts Will Dig a New Panama Canal

With nuclear "dynamite", a giant sea-level ditch is easy

By S. David Pursglove

FOR a quarter of a century, dreamers and hardheaded businessmen as well have been conjuring up new schemes to jockey huge ships across the aggravatingly skinny, but mountainous,



ROW CHARGE technique, tested with 13 simultaneous "nitro" charges in Nevada, produced this continuous ditch. Nuclear charges will dig new canal similarly

FIVE POSSIBLE ROUTES for a new canal have been selected from 30 alternates. They include: (1) Tehuantepec, through Mexico; (2) Greytown-Salinas Bay across Nicaragua; (3) San Blas through Panama; (4) Sasardi-Morti through Panama; (5) Atrato-Truando via Panama and Colombia. Present canal is (6). Nuclear explosives would blast canal as shown on previous page

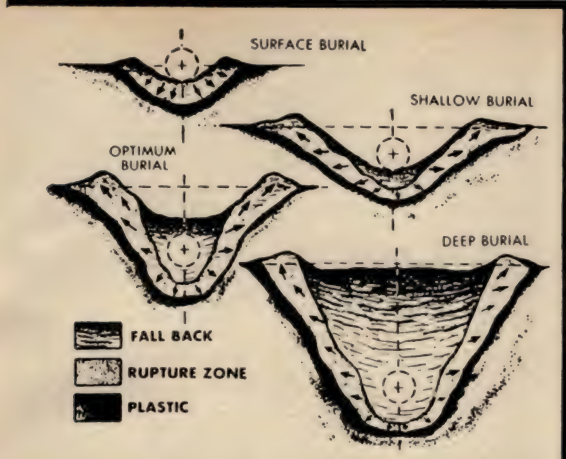
strip of land connecting North and South America. Ambitious promoters have proposed tunnels through the alpine backbone of the Isthmus, lake chains connected by man made rivers and—wildest of all—a king size railroad on which ships would ride piggyback from ocean to ocean.

But the fondest dream of all has been a colossal sea-level ditch. Today, that idea is no longer a dream. It may happen—and soon. It can be done without squadrons of earth-moving monsters—at one-third the cost they would involve—and will result in an ocean-to-ocean river four times wider and twice as deep as the present canal; a "ditch" big enough to take the world's largest tankers and carriers—something the present canal won't do.

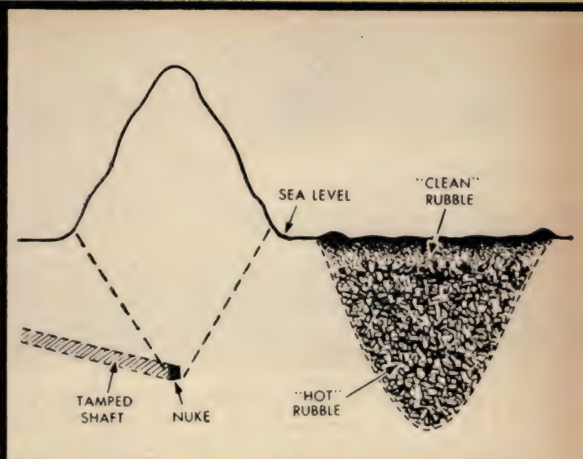
The question is no longer "Can it be done?" It is "*Where, how and when* can we dig it?" Scientists and engineers working with the U.S. Government's Panama Canal Company, the Atomic Energy Commission and the Army's Corps of Engineers already have most of the answers.

Where? Near the Panama-Colombia border. How? By means of thermonuclear excavation based on new techniques. When? Within five or six years. These decisions are firm. All that remains to clear the way for the first blast is the necessary diplomacy and official approval.

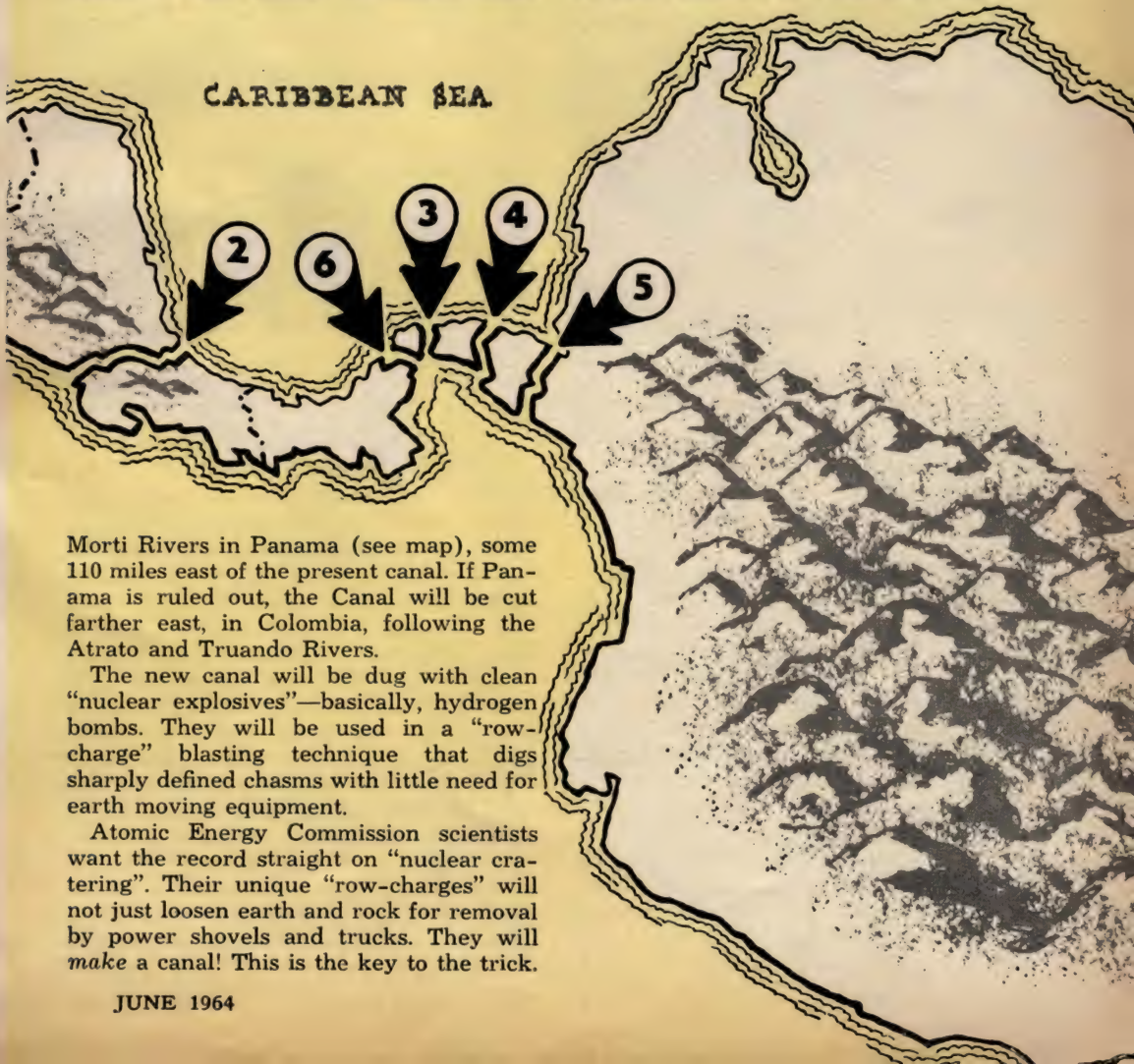
The best route, from an engineering standpoint, lies along the Sasardi and



CRATER PROFILES show how shape of ditch can be determined by depth at which explosive charge is planted. In these sketches, (X) indicates charge



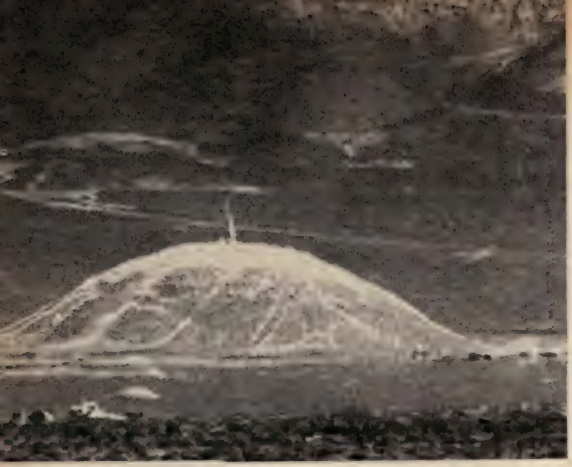
SINGLE CHARGE, if buried deeply enough, as shown above, will not only level an entire mountain, but will throw rubble so that it falls back, filling ditch



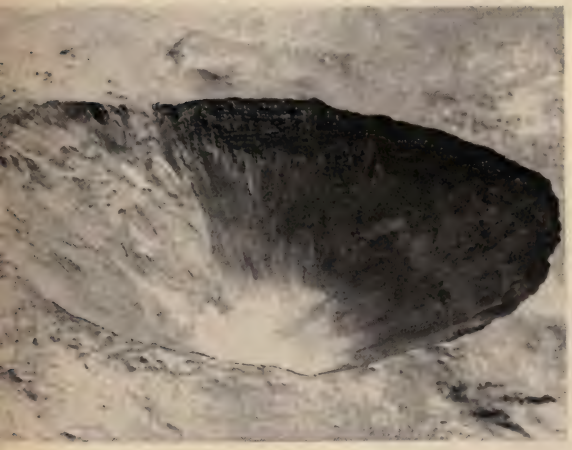
Morti Rivers in Panama (see map), some 110 miles east of the present canal. If Panama is ruled out, the Canal will be cut farther east, in Colombia, following the Atrato and Truando Rivers.

The new canal will be dug with clean "nuclear explosives"—basically, hydrogen bombs. They will be used in a "row-charge" blasting technique that digs sharply defined chasms with little need for earth moving equipment.

Atomic Energy Commission scientists want the record straight on "nuclear cratering". Their unique "row-charges" will not just loosen earth and rock for removal by power shovels and trucks. They will *make* a canal! This is the key to the trick.



GIANT BLISTER, 800 feet wide and 290 feet high was phenomenon produced by 100 kiloton Sedan "bomb", buried deep underground. When the bubble burst . . .



. . . it revealed a crater measuring almost a quarter of a mile wide and 320 feet deep. Some 7.5 million cubic yards of earth had disappeared completely

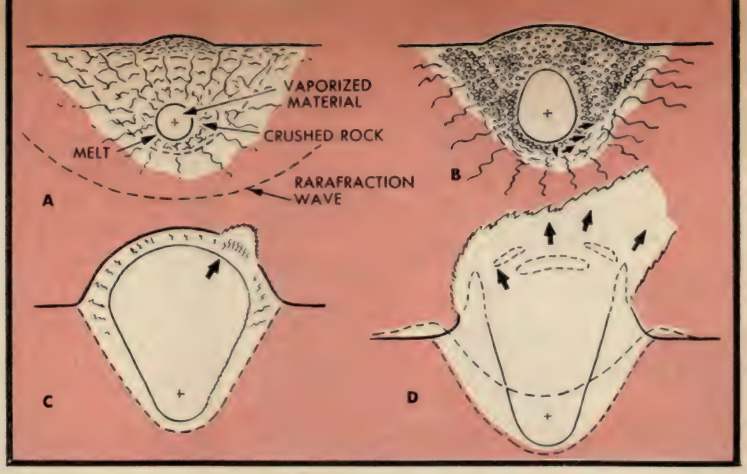
"CLEAN" BOMB produced such low radiation levels that scientists in everyday clothing entered the Sedan crater on a cable only six months after blast

The A.E.C. developed the method in a series of Nevada tests. Eight more blasts, spread over four years, will be sufficient to refine the system.

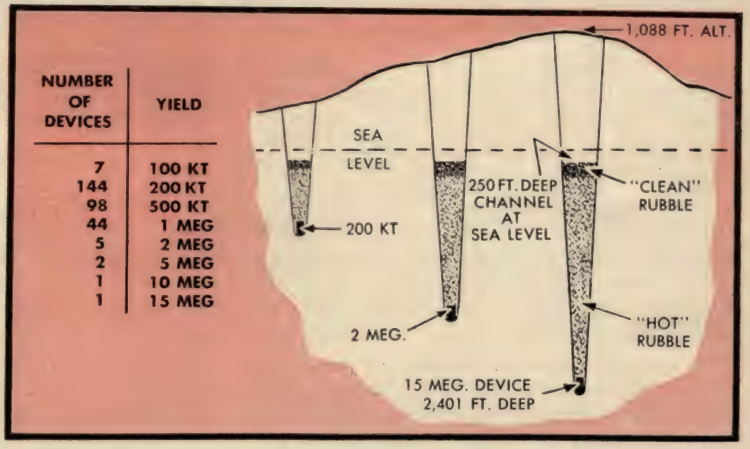
Actually, some 30 routes across Central America were studied by the Canal Company. These were narrowed to five by the A.E.C. Next step: to survey and core-drill the Sasardi-Morti and the Atrato-Truando routes. If one of them meets international and geophysical requirements, A.E.C. Chairman Dr. Glenn T. Seaborg insists digging can begin five or six years later.

Real secret of the new technique is called diffusion blasting, first developed with conventional explosives and more recently applied to nuclear devices. Engineers have worked out formulas that tell them what size of charge to use, and how deep to bury it in order to blast out a particular size and shape of hole. They can produce ready-made railway cuts, steep-walled craters, or even remove mountains. They can so arrange their blast that the debris will fall into a gorge and form a precisely located dam of specific dimensions.

A dozen years ago, in a series of Nevada tests with way-out names like "Buster Jangle-U", "Teapot ESS", "Neptune" and "Danny Boy", A.E.C. learned what happens when nuclear explosives are detonated at various depths in the earth. In 1951, "Buster", yielding 1.2 kilotons, or the force of 1200 tons of TNT, was set off 17 feet below the surface. It dug a crater 53 feet deep and 258 feet across. "Teapot", tamped in a 67-foot hole, formed a crater 294 feet in diameter and 90 feet deep. "Neptune", a 1/10th-kilotron bomb, was buried 100 feet deep and formed a shallow



BUBBLE DEVELOPMENT in an underground nuclear blast progresses as shown in sketches above in this four-stage alphabetical sequence. Blow occurs via the tamped hole where the charge was inserted; it appears here in stage C



SASARDI-MORTI canal route would call for 302 nuclear devices with a total yield of 170 megatons equal to 170 million tons of TNT. To cut a sea level ditch in simultaneous explosion, bomb depths would vary as shown here

crater. "Danny Boy", a tiny 0.4-kiloton "firecracker" blew a precisely predicted crater in hard rock—proving to physicists that their formulas applied to many types of excavation material.

After more tests with nuclear as well as chemical explosives, scientists began to nail down a basic cratering theory. It says in part that the deeper the charge, the wider and deeper the crater—up to a point. After that, debris flies straight up and down, re-filling the hole.

Following this series came "Sedan", first whopper in the Plowshare program aimed at testing newer, cleaner nuclear explosives for peacetime uses. Sedan had a yield of 100 kilotons, equal to 100,000 tons of TNT. With five times more oomph than World War II atom bombs, it proved itself a mighty tool for earth moving. The charge itself was packed in a cylindrical canister eight feet long and 34 inches in diameter, which engineers lowered down a 635-foot shaft in soft Nevada soil. Early in July, 1962, they pushed the button. Observers watched, fascinated, as the earth trembled. The desert floor surged upward in a huge blister 800 feet across and 300 feet high—then blossomed. Fiery gases burst from it; a mushroom cloud soared skyward; earth and rock shot 2000 feet into the air. When the dust settled, scientists found themselves staring at a perfectly formed crater 320 feet deep and a quarter of a mile across. In a single, mighty whoosh, some 7,500,000 cubic yards of matter vanished.

As a result of this success, Sedan-type bombs—and bigger—are now being scaled down to 12-inch diameter for canal digging and other giant earth moving jobs.

ENGINEERS and scientists conduct a post-shot examination of rubble at the lip of the Sedan crater in order to determine radiation and make-up of debris

PROJECT "CARRY-ALL" in California proposes a rail and road cut through mountains with nuclear charges to test canal project feasibility. This is a model

The Sasardi-Morti route for a Central American canal would require 302 such charges with a total yield of 170 megatons —the output of 170 million tons of TNT. The "bombs" would range from 12 to 36 inches in diameter. The A.E.C. won't reveal the size of a whopping 15 megaton charge to blast out the canal at the point where the continental divide rises 1088 feet above sea level. But it will be husky.

What about radioactivity? Five days after the Sedan blast, engineers began working at the crater lip. Six months later, an A.E.C. photographer tramped a zigzag course through the knee-deep, powdery fall-back down to the crater's floor and photographed a four-man team. The radiation level was so low that they did not need protective clothing. Within five years, the A.E.C. contends, radiation will be 100 times *less* than the Sedan count.

This cannot be called a health hazard. But, it can be *measured*, and the limited nuclear test ban treaty specifies that underground blasts may not result in *any* radioactivity outside the national boundaries. Hence, diplomatic agreements must be forged before work can start.

Meanwhile, the A.E.C. can continue to develop the necessary explosives, conduct cratering experiments and carry out experimental excavations in this country.

One such experiment is "Project Carry-all", a plan to cut a railroad and highway pass two miles long through California's Bristol Mountains. It calls for 22 nuclear explosives adding up to 1730 kilotons.

If Carry-all is undertaken, it will give the world a good look at nuclear earth moving. It *is* hard to imagine a row of explosives producing a straight, smooth-sided, clean-bottomed trench with the dirt and rock piled neatly along the sides and none thrown out at the ends. But that's what happens in "row-charge."

How does it work? Charges are planted so the distance between them is little more than the radius of a single crater. When the charges detonate simultaneously, there is a "doubling effect" at the points where the impact of one charge meets the punch of its neighbor. Not only does this remove 20 percent more material, but it forms a long, smooth-walled trench instead of a line of craters. Even more astounding is the odd fact that row-charge excavating throws the dirt neatly to the sides of the trench; none goes out the ends. Experts suspect that a vacuum forms along the sides of the long row of explosives.

What would a nuclear-dug canal through the Isthmus cost? The Sasardi-Morti route is now estimated at $500 million—far less than the $5 billion estimate for doing it conventionally and one-third less than an estimate made four years ago, thanks to new developments in handling our newest earth mover—the atom. ★★★

Pushbutton Pool Cover

Operating on battery power, an accordion-type swimming pool cover needs no tracks—and can be rolled away from the pool for storage. An automatic device realigns the cover to roll back over the pool.

Made of aluminum panels that unfold from a two-wheeled frame, Pool-Deck operates on a 12-volt battery. A removable pushbutton switchcord eliminates any possibility of the cover being opened by anyone but the owner. It is made by Pool-Deck, Inc., 1600 S. Union Ave., Bakersfield, Calif.

For a Busman's Holiday

Wood paneling and French windows are two of the features of a motor bus converted into a home in Essex, England.

Custom converted at a cost of $1400, the mobile home is equipped with a living room that contains a piano, a complete bathroom and kitchen with electricity and bottled gas for cooking. In typical English fashion, there is also a small roof garden.

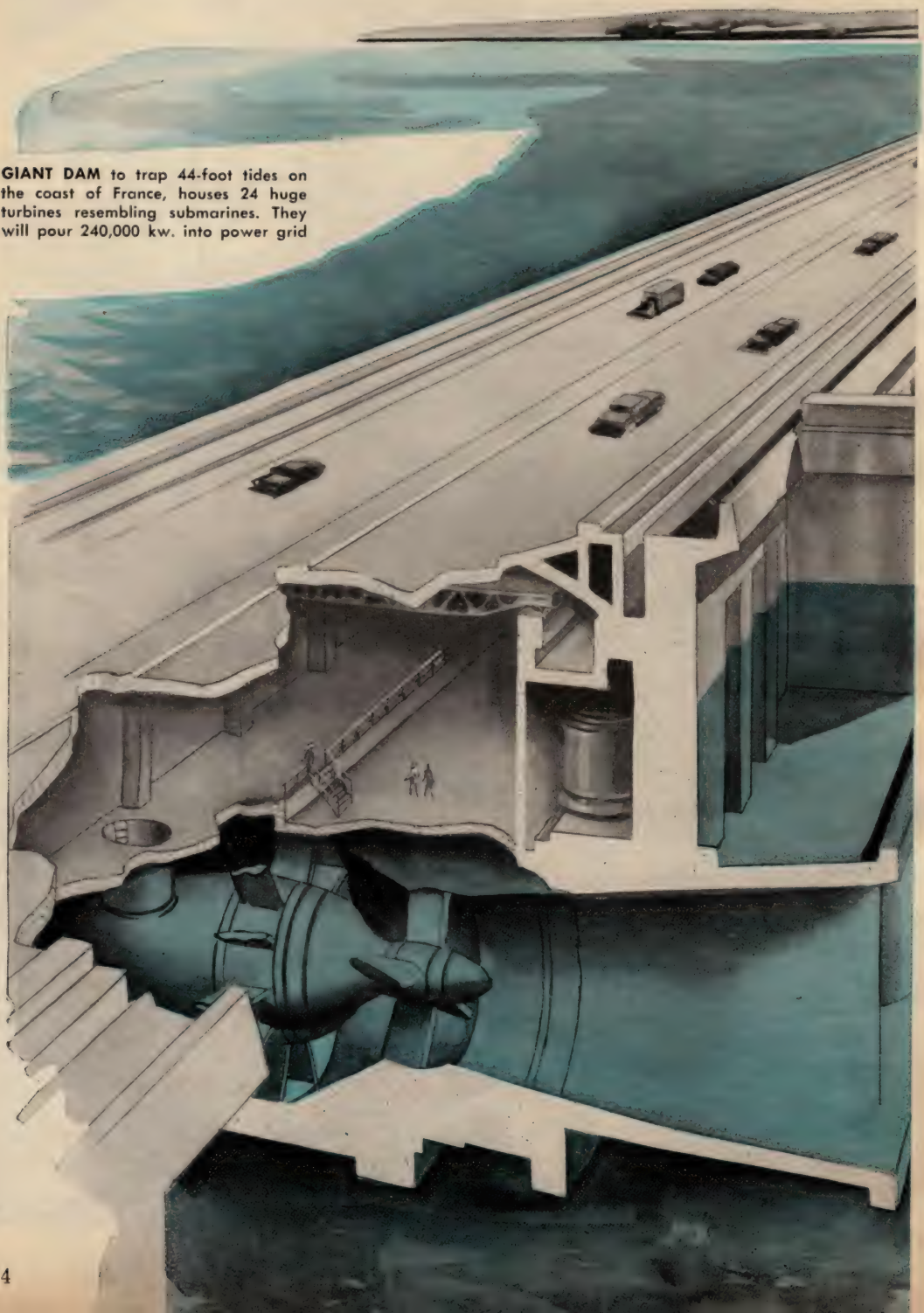
Midget Mace

The big one (inset) is called the TM-76 and it's a 1200-mile subsonic missile that's launched by a booster rocket and cruises on its own jet engine. Its popular name is *Mace*.

An airman in the Air Force's Tactical Missile School has duplicated this operational weapon (but without the warhead), scaling it down two-thirds of an inch to one foot. His midget *Mace* is made of wood with a built-in model jet engine and simple guidance system, and an outboard booster bottle developing one pound of thrust.

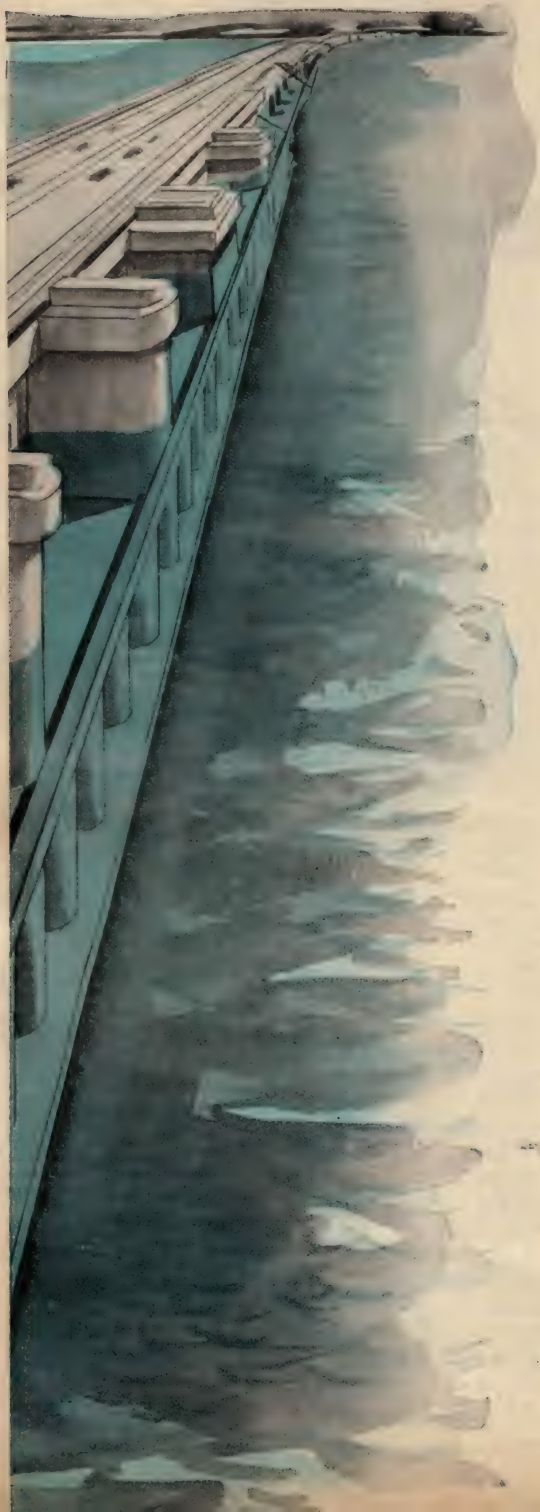
The model missile flies a programmed box pattern in 40 seconds and floats to earth on a small parachute.

Moon Power for



GIANT DAM to trap 44-foot tides on the coast of France, houses 24 huge turbines resembling submarines. They will pour 240,000 kw. into power grid

the Lights of Paris



The dream of harnessing the tides to produce electricity is becoming fact in northwest France

By Harland Manchester

FOR MORE THAN 200 years men have talked of harnessing the rising and falling ocean tides to power their industry. Now, near the ancient French town of St. Malo on the English Channel, where the Coast of Brittany is pierced by the Rance River, one of the century's great engineering feats is nearing completion.

In the deep valley from St. Malo a corps of 900 workers has created a great reservoir extending almost to the city of Dinan, 15 miles upstream. Its purpose is to impound the formidable channel tides and route them through ingenious new turbines to produce electricity. And near St. Malo, engineers from the state-owned power system are building a $90-million tide-powered hydroelectric plant to help light the lamps and drive the machines of their rapidly progressing nation.

The St. Malo site has long tempted power experts because its tides are among the highest in the world. The channel coasts of France and England shape the incoming Atlantic waters like a hydraulic engineer's dream, breaking them against the 90-mile-long Cotentin Peninsula which stands at right angles to their march. Buffeted back, these waters swell and sometimes raise the sea level as high as 44 feet. Twice a day the sea surges up the Rance River to Dinan, reaching a maximum volume of some 280 million gallons a minute, then withdraws, leaving a long, slender triangle of barren gray basin behind.

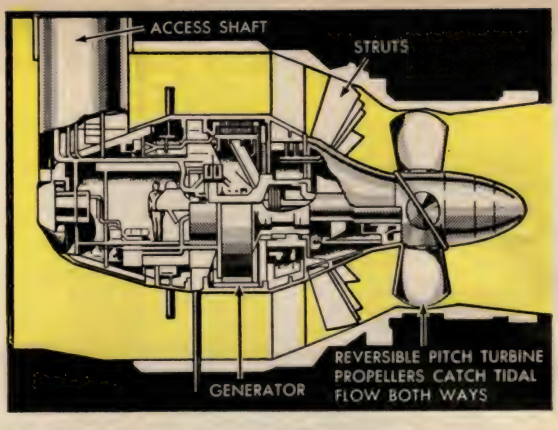
For centuries, Breton millers on the river's inlets have utilized driblets of the great flood. Such a mill, now inactive, can be seen near St. Malo. The high tides passed through one-way gates to fill their millponds; then, as the water drained off during the ebb period, it turned waterwheels to grind the grain of local farmers.

Ever since a French military engineer named Bernard Forest de Belidor first got the idea in 1737, occasional "visionaries" have been proposing methods for

harnessing the tremendous wasted bounty of tidal energy for industrial purposes. One of the plan's most tenacious and competent advocates, a dynamic 60-year-old engineer named Robert Gibrat, has succeeded after a 20-year campaign in persuading his technical colleagues and the men of money that the old dream would pay off.

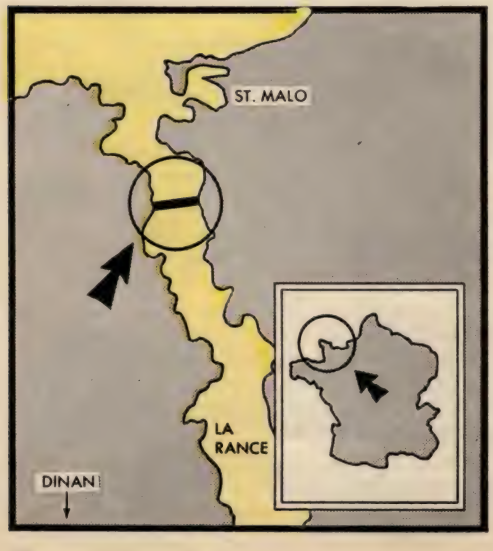
The son of a Brest physician, Gibrat rambled the rugged Breton coast as a boy and was hypnotized by the savage power of the tides. He is a lifelong student of all methods of power production, and at 36 he became Director of Electricity Distribution of France's Ministry of Public Works. With little time for speculation during week day business hours, he went to his office one October Sunday in 1940 to look over some old files which had aroused his curiosity. There he found a dusty folder of shelved tidal power-plant proposals, among them a scheme for harnessing the tides near his native Brest. The deeper he delved, the more excited he became, and he paced the floor for hours weighing the problems and potentialities involved, and making notes on possible sites.

After studying maps of coasts and currents and tidal data, he concluded that St. Malo was the most admirable tidal energy site. He designed a hydroelectric system to harness both incoming and outgoing tides,



POWER UNIT resembles pot-bellied submarine and features giant propellerlike reversible turbine; 24 of them will be located in central part of dam

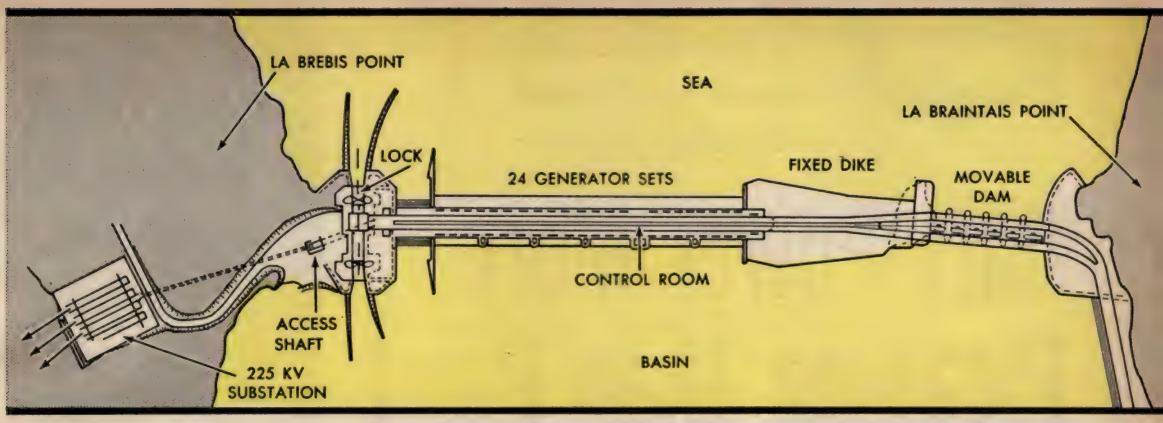
COFFERDAM under construction, showing cylinders of lower wall of oval lake being put in place. In foreground is six-gate sluiceway to help control tides



GIANT TIDAL DAM, world's first, is below St. Malo on the Rance River in northwest France. Tides formerly swept upstream 15 miles to city of Dinan

to drive turbines for the generation of power.

Now Gibrat organized a private industrial research group to conduct studies and promote the project. This group, later incorporated in Electricité de France, with Gibrat as consulting engineer, pursued an intensive program to design components for the revolutionary plant. To aid in solving problems never met before, an accurate scale model of the entire tidal basis was first constructed in a huge laboratory at St. Malo. There the banks and bed of the Rance are meticulously reproduced in concrete in a miniature river system 490 feet long. Every rock, shoal and structure all the way from St. Malo to Dinan has its counterpart. By studying the movement of the model river, the effect on the future



OVER-ALL VIEW of tidal dam. Access shaft to equipment is on left bank. Near bank is lock to allow passage of river traffic. Center of dam houses 24 reversible turbines. Next is fixed dike, then controllable dam with six gates

CONVENTIONAL CAISSONS were used to assist underwater operations. Foundations for concrete cylinders of cofferdam had to be built at river bottom

UNCONVENTIONAL CYLINDERS of prefabricated reinforced concrete were set up like picket fence, then gaps between them were filled in to make cofferdam

dam of currents, tides and storms could be accurately forecast.

The actual work of building the dam on the Rance began early in 1961. When a conventional hydroelectric dam is built, a one-way stream is leashed and diverted around the site by a single cofferdam, and the engineers build the power dam in relative peace and quiet on dry land. But the St. Malo project engineers have had to cope with periodic two-way floods strong enough to demolish buildings in their path, while conditions of work change every minute with the rising and falling waters.

In the early stages of construction the plan called for building the ends of the dam first, thrusting out from each bank. Near the west bank a lock was built inside a cofferdam. The lock would later permit the passage of river shipping. In erecting the preliminary cofferdam, workers snatched time at low tide to pour concrete, then waited while the water rose and receded.

Near the east bank, a small rock island served as a mooring post, and a sluiceway was built with six great steel gates. The gates later could be opened to pass the tides in either direction.

Then the great problem was to bridge the gap between. Engineers decided to create, in the middle of the river, an oval lake some 1800 feet long by building walls in one of the world's toughest locations. The lake could then be pumped out to provide dry ground for building the per-

(Please turn to page 212)

PM OWNERS REPORT

A Nationwide Survey
Based on 1,488,585
Owner-Driven Miles

Dart Power More Pleasing than Paint

Marginal and boldface comments by Jim Whipple, PM's Automotive Editor

"IT'S EASIER TO DRIVE in winter than my Comet was, runs very smoothly at turnpike speeds, and handles exceptionally well."

So says the New York chemist. But, he notes, "I'd like to see more evidence of corrosion control. I'm afraid the car won't hold its good looks through three years."

By adding praise for the "exceptionally large trunk space" and comments on "a tendency to stall during rainy weather" and "considerable wind noise," our scientific friend has managed to touch on most Dart owners' likes and dislikes.

He concludes by saying he'd buy another Dart (79.7 percent of owners agree with him) and rating it "excellent," as did 67.3 percent of the owners *PM* surveyed.

By way of comparison, Dart's big cousin, the 1964 Plymouth,

GOOD HANDLING CHARACTERISTICS were praised by Dart owners. Over 60 percent named it the feature they liked best. The clean, sleek styling also drew praise, although the durability of the finish was questioned by several owners

DART'S HATROOM in the front seat (see below) is generous and found praise from the owners *PM* questioned. Interior design also was generally pleasing

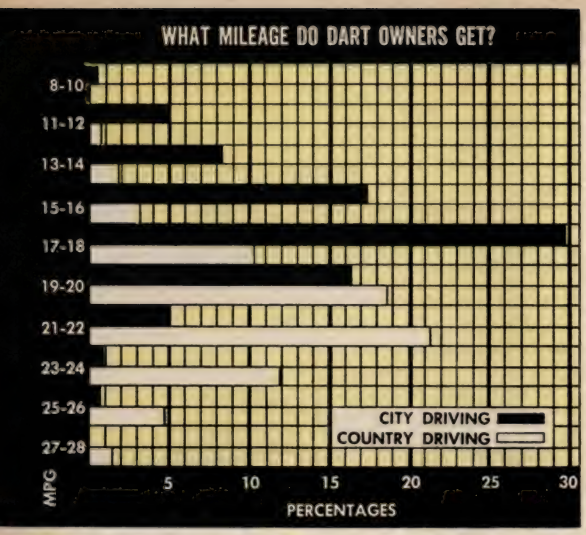
ABRUPT DROP COMING OFF our favorite bridge caused the Dart to bottom hard, but there was no feel of losing control. Owners paid tribute to handling

Owners Like

Boulevard ride	(66.3%)
Handling snap	(61.6%)
Six's power	(30.9%)

and They Dislike

Failing finish	(8.1%)
Anemic mileage	(5.3%)
Ill-fitting doors	(5.3%)



CITY DRIVERS generally got 17-18 miles per gallon while those on long trips usually averaged 21-22. Many expected more and expressed disappointment

DRIVING POSITION provoked little comment from owners. Pushbuttons on left were unhandy for some, but were praised as being beyond children's reach.

Plymouth's higher rating is probably due to slightly greater satisfaction with a larger car

It's worthwhile noting that the 145-hp. engine adds almost no weight over the 101-hp. engine. And that 44 hp. costs only $47, a real bargain

received an "excellent" tag from 73.1 percent of its owners. And for both of these cars, the unhappy owners who rated their cars "poor" were remarkably few in number—0.6 percent for the Dart and 0.3 percent for the Plymouth.

Displeasure with fuel mileage seems to be largely counterbalanced by a pleasurable reaction to the snappy performance of the car. A Pennsylvania teacher (whose 145-hp. Six gets 18 m.p.g. over-all) says "the mileage is good for the power I receive." (The optional V8 hadn't become available when our Dart owners bought their cars.)

For our own figures on fuel economy, *PM* ran its regular series of steady-speed checks with a fuel meter and electric fifth-wheel speedometer. Our Dart was a two-door GT hardtop, also with the optional 145-hp., 225-cubic-inch Slant Six. Equipment included the three-speed automatic transmission and power steering. Here are our results:

25.5 miles per gallon at 30 m.p.h.
25.0 miles per gallon at 40 m.p.h.
21.9 miles per gallon at 50 m.p.h.
19.8 miles per gallon at 60 m.p.h.
16.6 miles per gallon at 70 m.p.h.

With a general mixture of big-city traffic, expressway driving, and winding country roads, we obtained an over-all fuel figure of 18.4 miles per gallon in spring weather.

How about performance? Here are our acceleration times, with the engine in standard tune: 0-60, 10.4 seconds; 40-60, 5.4 seconds; 50-70, 7.6 seconds; 0-80, 20.1 seconds, standing quarter mile, 17.6 seconds (to 78.5 m.p.h.).

Now let's let the Dart's owners tell you what their five favorite features are, in order of preference:

Dart's ride and handling are exceptional for a car this size

"Long-trip riding comfort compares very well to larger cars."—Indiana foreman.

"I like the firm, but comfortable, ride and excellent road-holding characteristics."—California salesman.

"Easy handling, no sway on turns."—New York technician.

THE DART'S WIDE-OPEN TRUNK AREA PLEASED owners although a few commented on intrusive gasoline fill pipe. Others noted small articles can get lost around the sides. The spare tire is recessed under a mat and hardwood cover

"Handling and cornering are easy. I was overwhelmed at the things my little six-banger can do."—Utah lens technician.

"It handles like a large car; I put 10,000 miles on in four months."—California salesman.

"With the optional 145-hp. engine, there's lots of snap for a Six."—California teacher.

"I have excellent power in passing."—Georgia lineman.

"The over-all appearance is the best in the industry."—California auditor.

Dart's designers have successfully avoided ← *that "little, cheap car" look*

"It's sleek and plain, yet sharp."—Michigan miner.

"I like the good lines and sporty look."—Michigan engineer.

"More inside space than some 'big' cars."—Georgia merchandiser.

"There's extreme roominess for a compact and I am tall; there's plenty of headroom, rear seat room, and trunk space also."—California state official.

Now for the other side of the coin. Here are numbers one through five of the most common complaints by PM*'s owners:*

"My GT has a poor paint job—it came off in some areas."—Michigan engineer.

This is almost an industry-wide problem. ← *Years ago, paint stayed on the car but faded; today, it doesn't fade but chips off*

"The paint seems easily chipped on my Dart."—Missouri student.

"Paint is very thin in places."—New York hoist operator.

"The paint on the rocker panel is poor."—New Jersey teacher.

"My Dart is equipped with optional 2.93 economy axle, small (170) engine, and stick shift. Mileage should be considerably above average, but I get only 23 m.p.g. over-all."—Michigan newsman.

We've got news for the newsman. His mileage ← *is considerably above average*

"My 17.6 m.p.g. over-all (with the 145-hp. Six) is poor gas mileage."—Pennsylvania spacecraft tester.

"The dealer should tell the truth about gas mileage."—California janitor.

"Door construction, especially the hinges and latches, is poor."—Massachusetts policeman.

"Doors have been adjusted, but don't shut properly."—New

To achieve the good handling and sway-free ride, suspension must be firmer, thus the surface harshness on broken concrete →

Jersey accountant.

"Windows do not stay in their tracks."—California student.

"I need lots of front-wheel balancing due to small wheels."—Pennsylvania purchasing agent.

"Thirteen-inch wheels are too small."—Texas policeman.

"The 170 Dart rides hard over the dividers in older concrete roads, but it handles very well, gives a very comfortable ride, and has a solid feel."—New York systems analyst.

"Even small bumps in the road are felt and heard inside the car."—Texas accountant.

"It dances at high speeds, even on good roads, but this is not too annoying."—Colorado Air Force officer.

There's more to the good side. In order of preference, here are numbers six through ten of owners praises:

"Running heavily loaded at 75 to 90 m.p.h. on a 4000-mile trip in weather sometimes below zero, my Dart averaged 17.9 m.p.g."—Arizona mechanic.

He's talking about the 145-hp. Six which → *will keep up with the pack very nicely*

"I like the economy without any obvious loss in performance when compared to larger cars."—Oklahoma student.

"I like the economy of owning and operating the Dart."—Illinois chemical engineer.

"The size is just about right—not too large or too small."—Maryland plant superintendent.

"The size is right. I hope they don't spoil it by going bigger like the F-85 Olds did."—North Dakota optometrist.

Dart solves space problem by dropping spare tire below trunk floor →

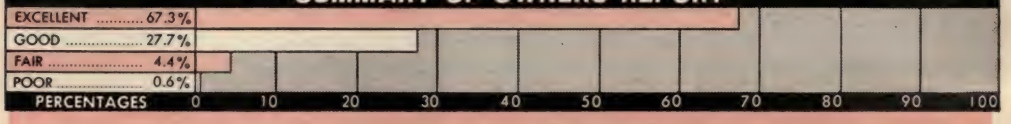
"There is enormous trunk space for a compact size car."—Indiana salesman.

"I drove 700 miles one day, comfortably."—Illinois clerk.

"It takes to the road just fine."—South Carolina textile worker.

(Please turn to page 192)

SUMMARY OF OWNERS REPORT



Best-liked features		**Least-liked exterior features**		**Other compact car considered, if any:**	
Riding comfort	66.3%	Rear end	7.5%	None considered	30.0%
Handling ease	61.6	Headlights	5.0	Chevrolet compacts	18.7
Power, performance	30.9	Grille	4.4	Ford Falcon	17.2
Styling	24.4	Rear quarter posts (poor visibility)	4.4	Valiant	16.2
Roominess	18.8	Bumper height	2.8	Rambler	10.3
Economy	16.9	**Best-liked interior features**		**Make of family's other car, if any**	
Size	14.4	Seats	30 9	Dart is family's only car	56.9
Trunk space	12.5	Dashboard	15.6	Another Dart	2.5
Roadability	10.3	Upholstery	13.4	Other Chrysler Corp. make	11.9
Specific complaints		Quality appointments	6.6	Chevrolet	5.3
Inferior paint finish	8.1	Pushbutton drive	6.0	Other General Motors make	10.9
Poor gasoline mileage	5.3	Legroom	5.6	Ford Motor Company make	7.8
Doors	5.3	Headroom	3.8	**Make of car traded in**	
13-inch tires are too small	5.3	**Least-liked interior features**		Dart	3.8
Stiff ride	5.3	No lock on glove comp'tm't.	7.8	Dodge	12.5
Wind noise	5.0	Dashboard	5.0	Other Chrysler Corp. makes	17.2
Location of gasoline filler	4.1	Small glove compartment	4.4	Chevrolet	6.3
Water leaks	3.8	Ash tray	4.4	General Motors compacts	4.3
Stalling (in damp weather)	3.8	Idiot light—oil pressure	3.1	Other General Motors makes	6.9
Mechanical trouble, if any		Pushbutton shift	3.1	Ford	7.5
None at all	73.4	**Mileage experience**		Other Ford Motor Co. makes	7.5
Carburetor	4.7	About as expected	52.2	**How is dealer service?**	
Brakes	4.3	Better	22.1	Excellent	58.8
Manual transmission	2.5	Not as good	25.7	Average	33.6
Automatic transmission	2.2	**Decision most influenced by:**		Poor	7.6
Four-speed floor shift	2.2	Price, trade-in	35.3	**Would you buy from him again?**	
Best-liked exterior features		Styling	32 8	Yes, would buy	65.9
Over-all body lines	25.6	50,000 miles/5-year warranty	20.3	No, would not buy	10.6
Clean, simple, uncluttered look	10.3	Economy	16.3	**Would you buy another Dart?**	
Hood	6.6	Size	15.9	Yes, would buy	79.7
Front end	5.6	Handling ease	11.3	No, would not buy	6.9

FOG DISPERSAL begins at 11:05 a.m. with airport visibility near zero. Contract plane flies pattern over runways dispensing CO_2 pellets from homemade hopper

AIRPORT VISIBILITY climbs to nearly a mile after 20 minutes. Dry ice changed cold moist air into drizzle. In two months, one airline made 22 otherwise impossible landings after defogging

Made-to-Order
Holes in the Clouds

IN WHAT MAY BE the first commercial-airline use of cloud-seeding techniques, a Salt Lake City operator has contracted with several airlines to defog the local airport on request. He raises runway visibility from zero-zero conditions to nearly a mile in less than 20 minutes.

A homemade dispenser, which includes a hand crank, is installed in the baggage compartment of a Beechcraft *Bonanza* just behind the cockpit. Dry-ice pellets are then churned into the low-lying fog bank.

Salt Lake City is a natural area for the technique, especially in winter. It sits in a valley and high-pressure air masses frequently follow fronts containing much moisture. Warm air aloft traps cold air near the ground, producing fog. Dispersing it allows scheduled airliners to land without diverting to other airports.

DISPENSING GEAR consists of hopper with a hand crank installed in light plane; pellets exit at arrow

DRY-ICE TECHNIQUE puts large holes in the fog layer as shown in this overhead view from defogging plane

RIDING THE NAVY'S FLOATING

PM's aviation editor climbs aboard a carrier jet and learns the violence of catapult take-offs and meatball landings

By Kevin V. Brown

THE MAN in yellow coveralls waved us on with short, choppy motions of his hands, palms toward his face. Our jet inched slowly across the flight deck. Sitting in the back seat behind the pilot, Cmdr. Jack Jones, I could feel the carrier roll ever so slightly as it plowed through the waters of the Gulf of Mexico. Rolling along on a moving platform is a queasy sensation you get only in a plane as it taxis on the deck of an aircraft carrier that's under a full head of steam.

The man in coveralls now pushed both palms toward us in one abrupt motion and our jet stopped behind the blast wall near the catapult. My head and ears were covered with a jet-pilot's helmet and the cockpit canopy was down, but I could still hear the noises of the flight deck. The jet ahead of us was being lashed into place and, as the cables strained, its engine began to roar. Then, as the roar rose in crescendo, the jet broke loose, slammed down the track and out over the edge. It wobbled

FLIGHT-DECK BALLET begins with yellow-suited director (left) nursing jet into place on catapult track. Green-covered catapult crew attaches cables and gets them up to proper tension for launch. Once tense, jet revs up, ready to go

SLINGSHOTS

momentarily, then straightened up and climbed gracefully above the horizon.

Now it was our turn, and that queasy feeling turned to fear.

The blast wall came down. The man in coveralls motioned us forward and we taxied over it. He waved both arms toward the left, pointing further down the deck where another man in yellow held one hand above his head—the signal that he was now in charge. Then he motioned us forward with both palms. As we inched onto the track, the nose wheel bumped over the catapult's horsecollar and the green-covered catapult crew swarmed around the plane.

We watched the signals from the

WHOOSH! Jet is literally flung into wind at better than 150 m.p.h. It's a bone-crushing sensation and plane actually slows down slightly after leaving deck

TWO FINGERS UP signals pilot to turn power on full. Author took this picture from back seat of jet just before being catapulted from carrier deck

ARM DOWN means "go." Catapult operator (far left) will now lower right hand and push "go" button. Notice 'copter hovering alongside ship in background

man in yellow which told Jones what to do and what was going on below us. The man pumped both fists above his head, motioning Jones to release his brakes and inch the plane forward until the rear cable was attached and tense enough to hold us back.

When the plane stopped, he held one hand above his head and swept his left arm across his chest and toward the front of the deck, signaling the catapult crew to tense up the forward cable by nursing the horsecollar forward. Now one cable under the cockpit was pulling the plane forward and the other under the tail was holding it back.

The next sequence went fast. The man in yellow—the plane director—held up one forefinger and rotated it rapidly. Jones checked his instruments, and nodded. The man rotated two fingers. The green-covered crew scrambled from under the plane as Jones revved our engine to full power. The noise became deafening. Jones checked his instruments again, saluted toward the plane director, and the latter's left arm swung toward the bow.

There was a pregnant pause as we hung there—then "WWHOOPP!" My helmet snapped back against the seat rack. A ton of pressure hit my chest as the plane shot down the flight deck and out over the Gulf.

Like the jet ahead of us, we slowed noticeably as we went over the edge,

MEATBALL SHOWS up as author's plane turns on approach. It's the single light in center of row of lights at left edge of deck. If pilot keeps meatball centered, his plane's tailhook will hit the third cable on deck every time

CREW SCRAMBLES from underneath plane just before it blasts off. Front cable attached to shuttle will pull plane down track after tension bar attached to the rear cable snaps. Note man bouncing on front cable to test the tension

wobbled, then smoothed out as Jones gained control and lifted the nose in a graceful climbout.

It was just one more catapult take-off from the deck of a United States aircraft carrier, but it was my first.

Popular Mechanics requested the ride to get caught up on the changes in the mechanics and techniques of carrier operations since the Navy's glory days of World War II and Korea. I spent two days on the USS *Lexington* in the Gulf of Mexico, and one sleepless night (night operations lasted well past midnight), and toured the ship from bow to stern. I learned that much was the same as in the old days, but with important differences and a few surprises to a layman.

LSO (left) no longer waves flags at incoming pilots. He uses mike to talk to them instead, plus signal lights, but meatball system does most of work now

One of the surprises is that the three major changes in American carriers—the steam catapult, the canted deck and the "meatball" landing system—are not American at all, but British. The Royal Navy created them and we copied them.

Back in World War II, all carriers had straight decks. The old prop planes took off over the bow and landed with the help of the LSO (landing signal officer), who nursed them with flag signals down to the deck where they hooked one of the cables.

About all that's left of that system are the cables, and even they have been reduced from a baker's dozen to four. A major problem with the straight deck was the awkwardness of trying to land aircraft and get others off at the same time. If a landing plane missed all the cables—and many did—they rammed into cable barriers protecting planes on the forward part of the deck. Many planes even flipped over the barriers and plowed into the aircraft.

The canted deck solved that problem. The rear half of the deck was offset to the left. If the front half of the carrier points to 12 o'clock, the rear half points to 11 o'clock. Now if a plane misses the cables, it takes right off again—or goes over the edge alone. More important, both take-off and landing operations can be carried on simultaneously.

The "meatball"—or, technically, the mirror landing system—made landings more accurate and frequent. It consists of four lights which shine forward into a large mirror. The mirror is concave, curved in-

HOOKRUNNER (left), man with most dangerous job in Navy, dashes out to disengage tailhook from cable. If cable snapped before plane stopped, it could tear a leg off. Meatball mirror is shown from the rear at upper left

ward like one of the mirrors at an amusement park, so the four lights are merged into one large orange ball—the meatball. The mirror is tilted so that the meatball is reflected back along the approach path. If the pilot keeps the meatball dead center, his tailhook will hit the deck between the second and third cable and grab the third one every time.

The LSO is still there, but his flags are gone. He holds a microphone in one hand and two control buttons in the other. One button gives the "cut" signal (green lights on top of the mirror) and the other the "wave off" (red lights on either side of the mirror). Another row of horizontal white lights, five on each side of the mirror, helps the pilot align the meatball up or down to keep the proper approach altitude. White stripes on the deck help him align the plane (and the meatball) left or right to keep the proper approach direction. The LSO also makes terse comments: "Too fast, buddie," "Get your nose up."

The beauty of the system is speed and accuracy. In the old days, the LSO could handle only one plane at a time. The meatball can shine into several pilots' eyes at once on the long approach path. Also, the LSO couldn't always get the pilot to understand exactly what he wanted. The meatball is staring the pilot right in the face, and it doesn't lie. If it's in the upper left-hand corner of the mirror, he's too high and to the left; lower right, too low and to the right.

The high-speed catapult system has been a great boon in the introduction of jets to carrier operation. Prop planes could —and still do—take off under their own power. Jets can't accelerate fast enough. So the steam slingshots were installed in the decks to literally throw the jets into the air. (They replaced the less-efficient hydraulic catapults of World War II.)

The system is buried below the deck, and looks like any other boiler room I've

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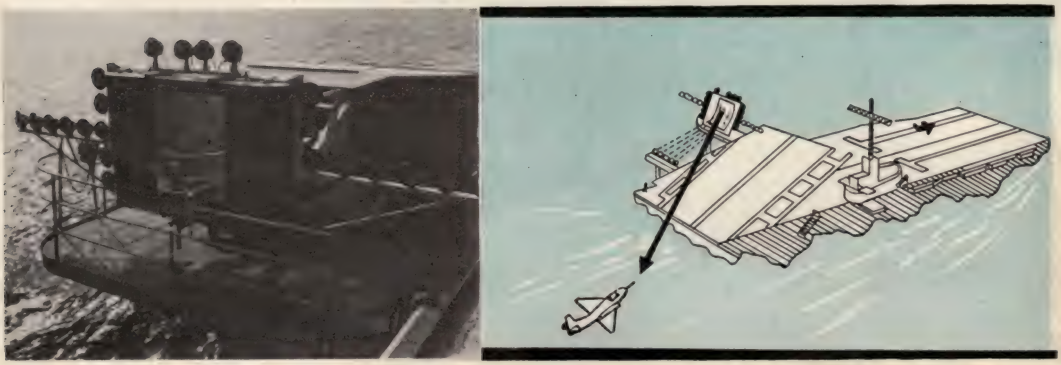
MEATBALL SYSTEM is shown in closeup (left) and in diagram. Four lights shine into concave mirror which compresses them into one large light. It is reflected up along flight path and guides pilots down with great accuracy



Fast-Shooting AR-18 Folds Up

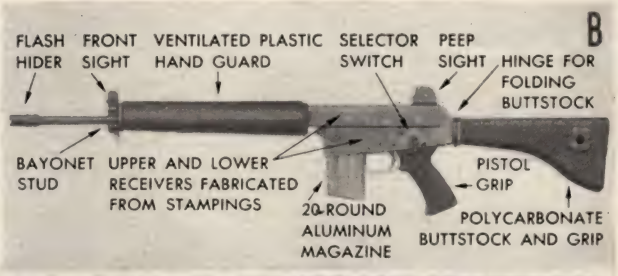
LESS THAN A YEAR after acceptance of the .223-caliber AR-15 as the ideal rifle for guerrilla warfare, the Army has a new contender in the Armalite AR-18, a lightweight (6.3-pound) weapon that is also .223 caliber and packs enough punch to blast down a concrete-block wall.

Fabricated to a great extent from sheet metal stampings and cheap screw machine parts, the AR-18 can be easily assembled in most machine shops. Only the polycarbonate stock, pistol grip and ventilated fore-end require special manufacture.

The 38-inch length reduces to 30 inches when the hinged stock is folded for carrying, and it is comfortably fired with just the pistol grip.

Tested by *PM* editor Tom Stimson, the AR-18 shot three-inch groups at 100 yards and 12-inch groups at 300 yards. It climbed slightly and traversed to the right on full automatic, but this was easily adjusted by leaning into it. It has so little kick it can be fired with the butt against the chin.

FIRED FROM ANY POSITION, the AR-18 displays recoilless sniper accuracy, and fires comfortably with just the pistol grip (below, A). Its nomenclature (B) is the epitome of simplicity. When fired at full automatic, the 20-round magazine empties in less than two seconds. The hitting power of the low-caliber magnum shells is demonstrated by blasting a concrete block wall (C), and cutting the blocks to ribbons (D) with just a single 20-round .223-caliber clip



Built-in Trim

Cockpit design of a new 14-foot runabout features an ingenious solution to the problem of proper load distribution. Two fuel tanks and the battery fit inside a centered rear seat, locating this weight along the keel and forward of the transom for quicker planing and stability. In addition, the shape of the windshield console encourages front-seat passengers to sit closer to the centerline.

The Mystic, which can use motors up to 50 hp., is made by Lone Star. It features that company's Foam-Pac bottom—a fiberglas/high-density-foam sandwich.

Roller Railroad

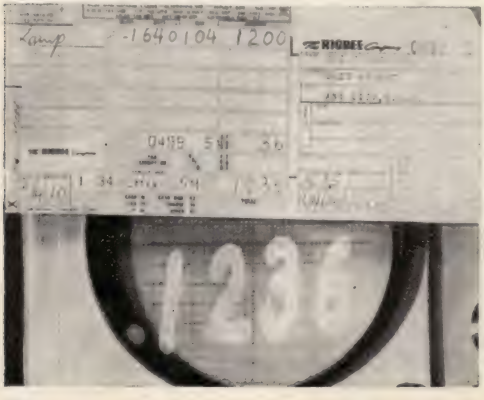
A train sliding along on rollers could achieve speeds of Mach 0.6 to 0.8, believes the designer after more than five years of testing scale models.

The rocket-shaped train, designed by Kyunojo Ozawa of Japan, slides through roller guides installed at intervals of about half the length of the vehicle. Ozawa plans to power the passenger-carrying train with turbojet engines.

The full-size train will have a 690-foot coach and will be similar to the one-20th scale plastic model at far right. Rocket power has been used in test runs.

Reads Handwritten Numbers

Sales slips in a Cleveland, Ohio, department store are being read and processed by a machine which recognizes handwritten numbers. The experimental optical reader feeds the figures into an IBM computer. In the photo, an oscilloscope displays sales figures as they are read by the sensitive handwriting reading machine.



Swedes Test New GEM

Three engines lift and propel a new Swedish ground effect machine, the Saab 401. One engine creates the air cushion which holds the vehicle four inches above land or water and the other two operate the propulsion and steering propellers. Top speed is 49 miles per hour. The machine weighs two tons.

Lightweight Garage Can Go Anywhere Car Goes

You can have an all-weather cover for your car—or boat or farm equipment—anywhere you wish by using the portable Fold-A-Garage. Springs in the frame ease the job of opening and closing the unit.

The frame is made of steel tubing. The cover is vinyl-laminated nylon, available in a choice of seven colors.

Available in sizes for standard cars and for compacts, the portable garage is 100 inches wide and 74 inches high. Prices range from $299 to $350. The maker is A. J. Smith Assoc., Box 302, Mt. Prospect, Ill. The cover material is flexible to 40 degrees below zero, reports the manufacturer of this take-it-with the garage.

Next Month I'll Set a New

SALT FLATS trial run of *Wingfoot Express* saw the jet-powered car hit 325 m.p.h. with only 30 percent power applied. In the photo above, driver in the cockpit prepares for a run along the black stripe—without afterburner

World's Record

TARGET is the 407.45 m.p.h. record set by the "Spirit of America", shown here, with Craig Breedlove at the controls last year on the salt flats

WINGFOOT is 26 feet long and aerodynamically designed to slice through air resistance and stay on the ground. Green is in cockpit in this picture

480 m.p.h. is built into "Wingfoot", and in July she'll prove it when I take her across the salt flats to beat Breedlove's record

By Tom Green
as told to Clifford B. Hicks

ON A HOT DAY in July I'll walk across the salt flats and squeeze into the cockpit of a streamlined stovepipe on wheels. Cables from an auxiliary starter will be connected to the engine, and the scream of the jet will pierce the silence to the distant mountains. When the engine is running smoothly at 20 percent power, the umbilical cords will be cast off. I'll ease forward the throttle, release the brakes and cut in the afterburner.

Twenty-six seconds later I'll be traveling faster than any man has ever moved on wheels. I'll beat Craig Breedlove's record of 407.45 m.p.h. to become the world's fastest man on wheels.

Strange as it may seem, the title means little to me. My greatest satisfaction will come from the knowledge that 20 years of amateur study of aerodynamic design have not been wasted; that the *Wingfoot Express* will do precisely what my calculations say she'll do. There's no question in my mind: *Wingfoot* is bound for a record on the salt flats this year.

Why am I so certain of victory? *Wingfoot* has the best power-to-weight ratio of any land speed challenger ever built—two horsepower per pound. Breedlove's *Spirit of America* has a ratio of less than one horsepower per pound. That's just one reason.

Don't get me wrong. I know Craig Breedlove, and have made an intensive study of his car. I have the greatest respect for both the man and the vehicle. In some ways his car is superior to ours. But we know *Wingfoot* can go faster than *Spirit*. The slide rule says so.

The "we" consists of Walt Arfons—one of the great names in racing—and myself.

Walt knows more about the application of jet power to racing cars than any man alive. I'm confident that I know as much about the aerodynamic design of racing cars as anyone in the business. *Wingfoot* is the culmination of our combined efforts.

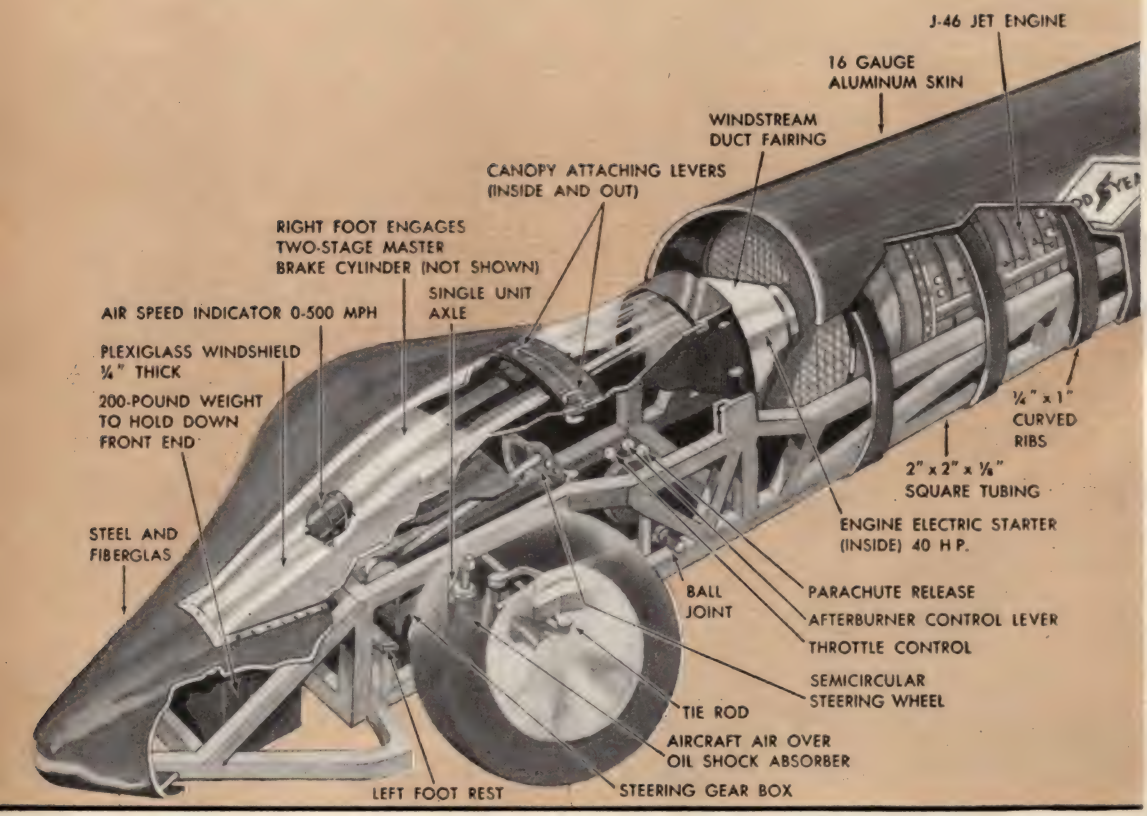
While I was still dreaming of building the world's fastest car, Walt Arfons was doing something about it. Walt has been racing for 15 years, and in 1959 became the first man to apply jet power to a racing automobile.

In the fall of 1962, I attended an auto show in Gary, Ind., on company business. There I saw the *Green Monster*, Walt's latest jet racer, and struck up a conversation with its owner. Within 10 minutes we were planning our assault on the world's land speed record.

Walt liked my theories on aerodynamic design. So, within a few days I sent to Akron (Walt's home base) four pages of configuration formulas for an ultra-high-speed vehicle. I also transformed the algebra into a balsa model. There has been virtually no change in the design of *Wingfoot* since the model was carved.

After several meetings, we finalized our

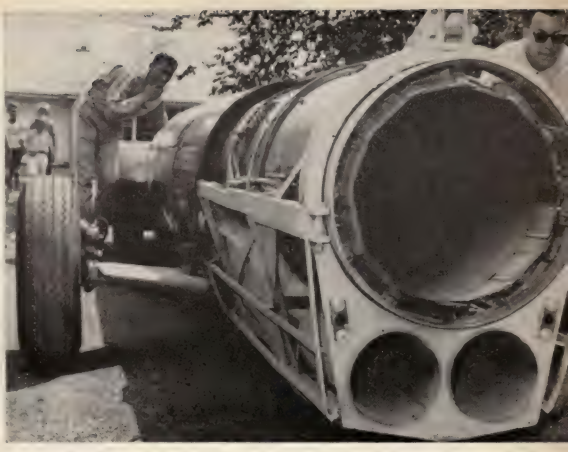
INSIDE VIEW of *Wingfoot* reveals sturdy skeletal frame, like aircraft fuselage, most of which is occupied by J-46 jet engine and the afterburner
Fairchild Studios Drawing


J-46 JET ENGINE
16 GAUGE ALUMINUM SKIN
WINDSTREAM DUCT FAIRING
CANOPY ATTACHING LEVERS (INSIDE AND OUT)
RIGHT FOOT ENGAGES TWO-STAGE MASTER BRAKE CYLINDER (NOT SHOWN)
SINGLE UNIT AXLE
AIR SPEED INDICATOR 0-500 MPH
PLEXIGLASS WINDSHIELD ¼" THICK
200-POUND WEIGHT TO HOLD DOWN FRONT END
¼" x 1" CURVED RIBS
2" x 2" x ⅛" SQUARE TUBING
STEEL AND FIBERGLAS
ENGINE ELECTRIC STARTER (INSIDE) 40 H.P.
BALL JOINT
PARACHUTE RELEASE
AFTERBURNER CONTROL LEVER
THROTTLE CONTROL
SEMICIRCULAR STEERING WHEEL
TIE ROD
AIRCRAFT AIR OVER OIL SHOCK ABSORBER
LEFT FOOT REST
STEERING GEAR BOX

plans and knew we had a winner. All we needed was money—no easy matter. An estimated $250,000 has been invested in Breedlove's car. Donald Campbell has millions in his *Bluebird.*

I'll never forget the day we walked into a conference room to present our case to 13 Goodyear executives. I asked for a blackboard. With only a piece of chalk to help us, Walt and I proved our case even though Goodyear already had committed money and special tires to Breedlove's car.

I proved by calculation that Donald Campbell's car can't possibly top 400 m.p.h.



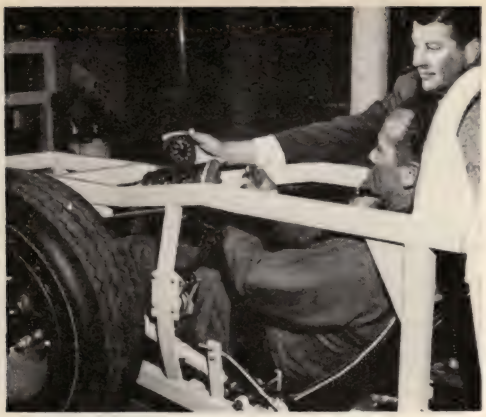
STOVEPIPE-POWERED car is rolled out of author's driveway to make room for the trailer that will carry it to Bonneville on the first big trial runs

Then we discussed Dr. Nathan Ostitch's car. My calculations showed that this car had a maximum speed of 360 m.p.h. A few months later, Ostitch's top five runs on the salt flats ranged from between 359 to 360 m.p.h. I sent the news clipping to Goodyear. Ostitch's problem, in my opinion, is that his wheels and tires are too large, and all four are in the open, creating drag.

When I presented the case for our design, I decided that our greatest hope lay in complete frankness. I pointed out that our car is capable of precisely the same maximum speed as Breedlove's—480 m.p.h. I also pointed out that Breedlove's car is a fine example of aerodynamic design—in fact slightly superior to ours in some minor respects. One square foot of frontal area of *Spirit* will slip through the air easier than one square foot of *Wingfoot.* However, *Wingfoot* has fewer square feet of

COMPARISON OF THE WINGFOOT EXPRESS AND SPIRIT OF AMERICA

	Wingfoot Express	Spirit of America
Total weight	4600 pounds	8600 pounds
Over-all length	26 feet	
Tire diameter	29 inches	48 inches
Tire pressure	100 pounds	250 pounds
Rear wheel tread	96 inches	126 inches
Front wheel	Two wheels, 32-inch tread	Single wheel
Engine type	J46 with afterburner	J47
Fuel	Kerosene	Special jet fuel
Horsepower	8600 at 425 m.p.h.	Approx. 4800 at 425 m.p.h.
Thrust	7000 pounds	4400 pounds
Power-to-weight ratio	Almost 2 hp. per pound	Less than 1 hp. per pound



DURING CONSTRUCTION Arfons sits on *Wingfoot's* cockpit to check the dimensions as well as location of instruments. No details were overlooked

frontal area, so we regain what we have lost there.

I emphasized that Breedlove's car weighs almost twice as much as *Wingfoot* —8600 pounds compared to 4600 pounds. He uses 4400 pounds of thrust to move it, compared to our 7000. At 480 m.p.h. (which he may approach this summer) he has reached the maximum capability of his design. At that speed we'll reach our maximum too, but we can raise our top speed at least 20 m.p.h. simply by enclosing the two rear wheels.

Also Craig Breedlove's 39-inch wheels, even though they are enclosed, provide considerable drag. Our wheels are only 29 inches in diameter.

Most racing drivers, with the exception of Breedlove, are so oriented to engines, wheels and transmissions that they give little attention to aerodynamics. Our theory has been that aerodynamic design contributes at least 80 percent to the speed, and the engine the other 20 percent—at least these are the relative values we feel such factors should have.

Since *Spirit* and *Wingfoot* both have excellent aerodynamic design, power is our one indisputable advantage.

Theoretically an engine of only 250 horsepower can put a man in motion at a speed of 400 m.p.h. However, this would require almost perfect streamlining and extremely small wheels. Walt and I made an early decision that the easiest way to our goal was through the use of jet power.

Walt selected the J46 aircraft jet with afterburner, available on the surplus market for $400 to $1000. It develops a whopping 8600 horsepower at 425 m.p.h. with the afterburner. This power has permitted us to make minor compromises elsewhere in order to save money.

Stability is the one big problem of any high-speed car, but the selection of a jet engine solves much of it. The jet generates energy in a straight line, and its inertia acts like an invisible rudder. After the engine is turned off, the mass of the car itself contributes to straight-line motion.

In a jet car, the design problem is mostly one of keeping the front end up front. This is determined by the ratio of wind resistance between the front and rear ends, and somewhat on weight distribution. We —and Breedlove—have paid a great deal of attention to this factor.

One other design problem in high speed cars is to keep the car from becoming airborne. Some components of a streamlined car are basically shaped like airfoils, so that a tendency to lift may be generated. *Wingfoot* is just as narrow as we could possibly build her, and thus there is little tendency to lift. We solved any additional lift problem by weighting the front end and making a negative airfoil of it.

The only difference of opinion that Walt and I have ever had is over the number of front wheels. I claim that a single front wheel is superior; Walt argues that two are better. We compromised on two front wheels with a tread of only 32 inches.

Our frank discussion apparently impressed the Goodyear men because they gave us their support. They now are contributing sponsorship to two cars—one

(Please turn to page 202)

CRACK-UP of *Wingfoot* during first test run at 250 m.p.h. proved stability of the car when it maintained direction despite collision with fence

Lightweight and Waterproof

A new lightweight trailer is sealed against dust for the protection of luggage and can also be packed with ice for hauling game or perishables long distances.

The Mark IV trailer, which weighs 150 pounds empty, can carry a load of 600 pounds. It has a molded, rustproof body. Other features include removable interior tie-downs, a replaceable interior plywood base and a double safety chain. A padlock hasp enables the owner to lock it.

Priced at $229.95, the Mark IV is made by Contemporary Products, Inc., P.O. Box 3055, Milwaukee 18, Wisconsin.

It'll Bend Over Backwards

If you're partial to Salvador Dali paintings, you can create somewhat the same decor in your home with a Floppy Clock —which actually keeps time.

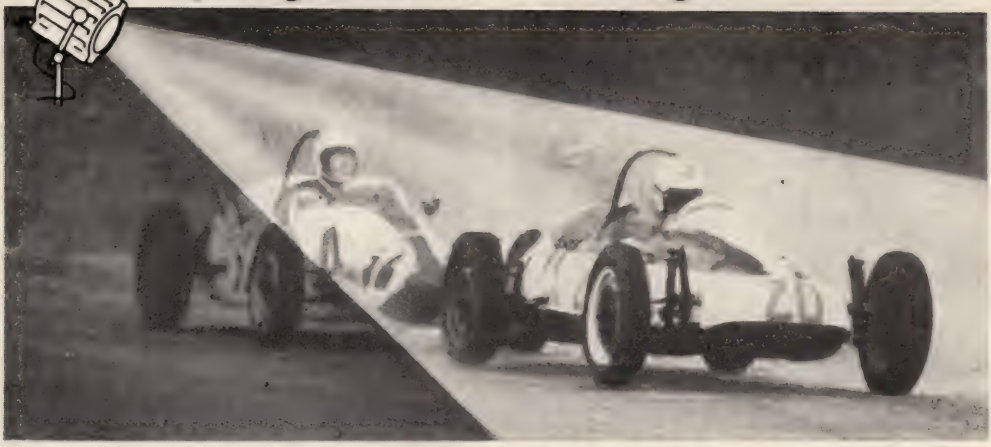
Made of plastic and measuring 12 inches across its face, the clock can be twisted and folded in nearly any shape, and it will stay in that distorted position. An electric motor, housed in the "winder," drives the hands via a flexible cable.

The Floppy Clock is manufactured by Paynter Products of Cincinnati, Ohio. It sells for $12.98.

Clamp-on Jet Motor

With a lower unit which needn't protrude beneath the keel of the boat, a new 5½-hp. outboard-type hydrojet motor scoops up 1000 gallons of water per minute and shoots it out the rear above the surface to produce 100 pounds of thrust. The 52-pound Outboard Jet is made by Outboard Jet, Inc., 226 N. Pine, Indianapolis 2, Ind., and is priced at $269.50.

Spotlight on the Volkswagen



FORMULA V RACER

What it is • How it behaves

"OLD VOLKSWAGENS never die; they just go racing!" This was one observer's reaction to the recent international debut of the Volkswagen-based Formula V racer. Here indeed is a car safe enough to serve as a basic trainer for novice racers yet with enough speed—90 plus m.p.h.—to offer a real challenge to the enthusiastic amateur race driver.

The concept of Formula V is similar to class sailboat racing where all boats are identical and the winner is determined by skipper's superior sailing skill and racing strategy.

The design of the V single seaters is so simple that you wonder why no one thought of it long ago. Perhaps someone did, but George Smith and Bill Duckworth of Orlando, Florida developed the idea beyond daydreaming and doodling. Together, Smith, a retired Colonel, and Duckworth, an engineer, designed a highly successful car around the standard engine, transmission and axle assemblies of the 1200 series Volkswagen.

The key to making an "instant race car" out of a VW is the engine flip. Smith and Duckworth simply turned the VW engine-transaxle assembly around so that the engine was located in front of the rear wheels instead of behind them, as it is in the VW itself. This move brings the engine's weight in between the axles for good (43% front, 57% rear) weight distribution with driver and fuel load aboard.

Setting the power plant in a tubular-steel frame with a wheelbase of 82 inches gave the V's designers a favorable ratio between an 82-inch wheelbase and stock VW width of 56 inches from tread to tread.

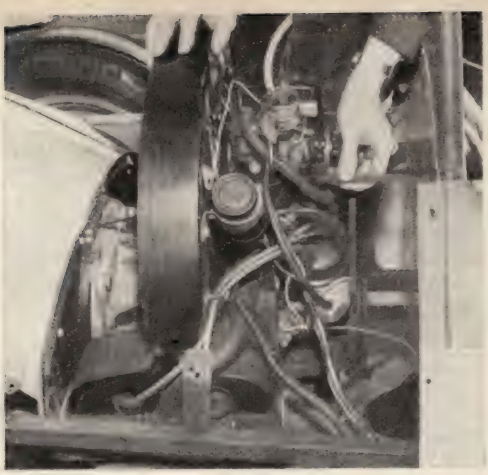
The front axle assembly is basically stock Volkswagen and includes the steering gear with new equal length tie rods to relocate the steering column in the car's center.

The rear "swing" axles support the car via a shock-absorber and coil spring unit and are located fore and aft by a trailing arm.

By this time sharp-witted readers will have spotted an amusing problem that faced the V's designers—if the engine is turned end-for-end in the chassis, the car will then have one slow speed forward with four speeds in reverse! Happily, there is a simple solution; when you swap ends with the engine, just rebolt the ring gear to the opposite side of the differential carrier, so that the drive pinion turns it in the opposite direction and everything comes out right.

For $945, Formcar Constructors Inc., the firm founded by Smith and Duckworth, will sell you all the finished parts that you need to assemble your own Formula V complete with fiberglas body and instruments.

All you need is a stock engine-trans-



ENGINE is easy to reach by removing fiberglas body panels held on with Dzus spring fasteners. Blower, damper and air cleaner are omitted for racing

axle unit, front axle, wheels and brakes from any VW 1200, the standard bug-shaped sedan.

For the complete box of parts, including fresh-from-the-factory engine, and transmission, less wheels and tires, Formcar's price is $1995. To those unwilling to undertake the six hour assembly job—few should be unable to cope with it—Formcar will sell a ready-to-race V for $2495.

What's a V Like to Drive?

An absolute ball! You'll need goggles and a helmet if you're going to be serious about it, though. (A sturdy roll bar is built in, as is a racing type seat belt.)

If you've never driven a single seat, open-wheel racer, imagine yourself in a sort of fiberglas canoe with wheels for outriggers, just inches from the track, doing 90 miles per hour. That's the feel you'll have from the cockpit.

We tried Formcar's factory entry on the track at Nassau the day after Charlie Kolb had romped it home ahead of the pack in the Volkswagen 100-miler (sedans and Formula Vs). Charlie maintained a 73-m.p.h. average.

(Full-bore race cars costing 10 times the price of a do-it-yourself V run the course in the high 90s.)

Eleven Seconds To Sixty

We found that the V accelerates to 60 in (10-11 seconds) a bit more than half the time required by the VW sedans, thanks to that weight reduction from 1600 to 850 pounds.

Larger rear tires effectively raise the V's rear axle ratio to permit the 90-plus top speed. All wheels must be stock 15-inchers, by the way.

Racing doesn't strain the VW engine which can readily be revved to 6000, while accelerating through the gears, according to Colonel Smith. Engine is raced dead stock with unmuffled exhaust and the cooling blower's thermostat ring removed.

In spite of reduced weight, the car clings to the road as if on suction cups, thanks to an anti-roll bar (in place of one torsion bar) and Koni shock absorbers (as used on the VW transporter) up front.

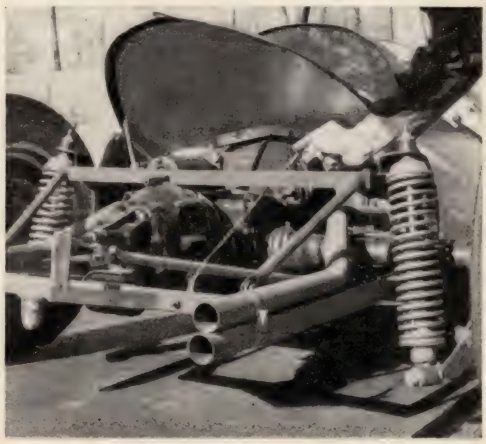
Bill Duckworth also strongly recommends retaining the hydraulic steering stabilizer found on late model VW's to keep the front wheels from flapping from side to side on rough pavement.

Stock brakes do a tremendous stopping job again thanks to the almost halved weight which doubles their effectiveness.

"Formula V racing is cheap to run in as well as to start in," says Colonel Smith. In three seasons of racing and a total of 30,000 miles on the original VW parts, he and Bill Duckworth have spent nothing on engine, transmission, clutch or brakes except an initial $30 to balance rods, crankshaft, pistons and the flywheel assembly.

For information on fast growing V racing, which has been sanctioned as a competition class by the Sports Car Club of America, write to Formula V Racing Association, Box 1088, Orlando, Florida. —*Jim Whipple*

UNDERSLUNG FRAME with side rail below VW swing axle permits low center of gravity. Jointed rods from rear of transmission give very precise shift action



Shock Absorber

TAKING THE KICK OUT of a 12-gauge shotgun, a California inventor has devised a hydraulic shock absorber that is built into the gunstock and reduces the 265-pound punch of a recoiling 12-gauge magnum shotshell to a gentle 40 pounds.

Developed by Ralph O. Hoge, the Hydrocoil is a hydraulic-piston system utilizing oil and air as compressing agents, and operating about the same as an automobile shock absorber. The recoil shock is taken up in two stages, the three small pistons absorbing the initial kick, then spreading the remaining force over a longer time span to reduce the total punishment on the shoulder of the shooter.

In a dramatic demonstration to test the effectiveness of his device, Hoge had an

ACTUALLY ADDING to the beauty of an expensive shotgun, the Hydrocoil is covered by a walnut "sleeve" that acts as a base for the piston action of the recoil absorption device. Installations require custom fitting

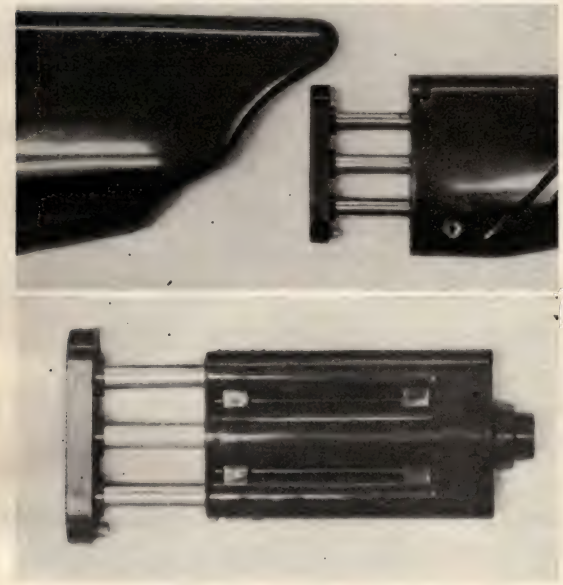
PHOTOGRAPHED at 1/25th of a second, two shotguns fire a 12-gauge magnum shell. With the Hydrocoil installed (below, left) the recoil is hardly noticeable, as compared to the leap of the gun (right) without absorber

for Guns

orthopedic surgeon, Dr. Charles Hutter, insert a needle into his windpipe to test pressure on the chest from firing the gun by recording impact on an oscilloscope.

Witnessed by ordnance experts, the test showed intense recoil shock to the brain, heart and blood vessels, a condition that was greatly lessened when the shock was taken up by the Hydrocoil.

HYDROCOIL is three pistons pushing against a cushion of oil and air in sealed cylinders. Inserted in the stock, it is covered with a moveable stock end



TESTING body damage from recoil of .338 rifle, inventor has instruments inserted into windpipe and attached to oscilloscope to show effect of 400-lb. shock

Missiles by Wire

Guided by thin trailing wires, missiles launched from a new antitank weapon are kept aimed at a moving target by the gunner with his telescopic sight. At rear is a missile for this full-scale model of TOW (Tube-launched, Optically tracked, Wire-command link guided missile) by Hughes Aircraft.

Throw Away Those Oars

Propelling a small fishing boat at 2 to 3 m.p.h. for trolling, a new manually operated outboard propeller is rotated by pumping the control lever up and down. This same handle is also used for steering. Made by Universal Projects, Inc., Jacksonville, Fla., the Man-U-Troll sells for $42.50.

Instant Grabbers

By Clifford B. Hicks

STEEL-TO-STEEL bond created by the new "instant" resins is capable of supporting four heavy men. Adhesive strength is 1700-1800 pounds per square inch

A NEW LINE of resins can develop, almost instantaneously, a high-strength bond that will withstand extremes of temperature and stress.

These resins develop tensile strengths of from 1000 to 2600 pounds per square inch in less than two seconds. In addition, they can be used to join permanently two pieces of dissimilar materials; for example, glass-to-metal and nylon-to-rubber bonds are possible. The resins are applied by simple hot-melt techniques.

Called by the family name of Versalon, the resins were not specifically developed as adhesives, but this may well become

UNSOLVED MYSTERY: Why Things Stick

WHAT MAKES *things stick together? Surprisingly, though adhesives are holding together everything from airplanes to houses, nobody really knows what makes things stick.*

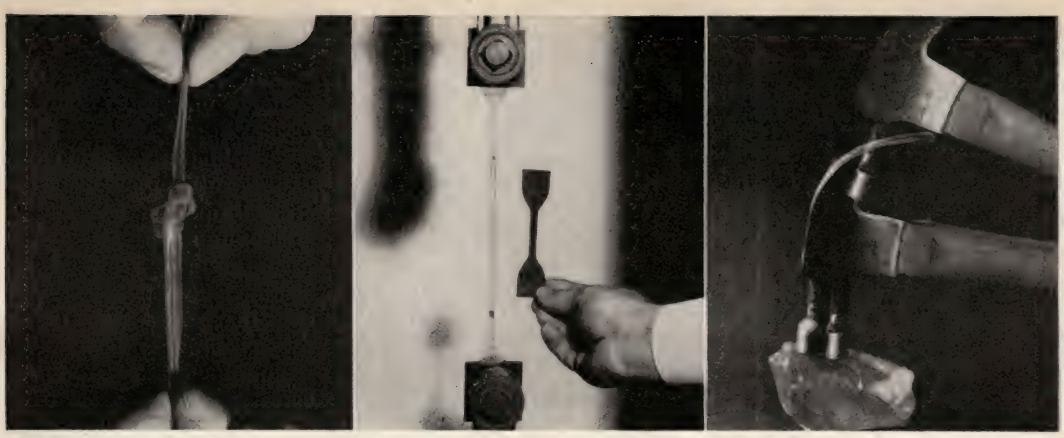
That's why the detective work in a small laboratory at Purdue University is important. Inside that laboratory, Dr. Brage Golding, head of the School of Chemical Engineering, is probing into one of the basic mysteries of the universe: the attraction between molecules.

Dr. Golding says we don't really know much more about why things stick than the caveman, who observed that blood, as it dried, would stick things together.

Many craftsmen are still convinced that roughening two wood surfaces before gluing them will strengthen the bond.

"In most cases," says Dr. Golding, "precisely the opposite usually is true. The smoother the surfaces the stronger the bond—if the surfaces are clean."

It's also common belief that an adhesive works by flowing between wood fibers or into the pits of a metal surface—in effect, holding the parts together with countless little physical rivets. This type of mechanical bond actually does occur when two pieces of porous material, such as cloth, are glued together. However, the assumption that all bonds are of this type came



FLEXIBILITY AND TOUGHNESS are characteristics of new resins. Tensile tester in center photograph stretches sample 400 percent, compared to original size. Glob of resin remains flexible under impact at minus 10 degrees

their major use because of their unique properties. In some industrial applications they may replace conventional nuts and bolts, screws, nails and rivets. They are expected to be used in shoemaking, construction work, automobile and appliance manufacture, and in the canning industry.

One member of the family has been designed specifically for low temperature performance, and will remain flexible and tough at minus 40 degrees F.

Stretches 700 Percent

Another Versalon resin will stretch 700 percent before breaking, and all of the resins have a high elongation capability.

Because the resins are nontoxic, they can safely be used for many applications in the packaging field. They also absorb virtually no water, and have other good electrical properties, so they may be used to encapsulate sensitive electronic components.

But the most appealing advantage of Versalon resins to industry is their "instant grab" ability, thus permitting the speed-up of many industrial processes.

The resins were developed by the Central Research Laboratories of General Mills. ★★★

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unglued when research revealed the startling fact that you can form an extremely strong bond between two nonporous, ultrasmooth surfaces which an adhesive could not possibly penetrate.

Most adhesives apparently bond by molecular attraction. These are the basic bonds that hold our world together.

But this bonding of molecules is still a considerable mystery to science. Dr. Golding points out two factors that are important to molecular bonds:

First, the closer the molecules of the two surfaces can come together, the stronger the bond. Surface molecules have great energy, and tend to attract other molecules.

Second, the cleaner *the surface, the stronger the bond. (A "clean" surface is one that has relatively few impure molecules.)*

"A good adhesive must have several characteristics," explains Dr. Golding. "In the first place, it must flow, so it will make intimate molecular contact. Thus most adhesives are liquids or semiliquids. Actually, many are solids dissolved in solvents.

"Second, adhesive must be chemically stable, so the bond won't deteriorate.

"Third, the molecules of the adhesive must have a strong attraction for each other (called cohesive strength); otherwise the adhesive itself would break.

"Fourth, the adhesive must consist of molecules with a strong molecular attraction for the material to be bonded."

Laboratory tests reveal that a bond reaches its maximum strength only if the two surfaces are in intimate molecular contact and free from impurities. ★★★

PM OWNERS REPORT

A Nationwide Survey Based on 1,229,359 Owner-Driven Miles

Non-Boxy American Sends Rambler Owners

Marginal and boldface comments by Jim Whipple, PM's *Automotive Editor*

RAMBLER OWNERS have long been considered practical, budget-minded types who demand hard value and are unimpressed by surface appeal. But suddenly this year, Styling is third among best-liked features listed by happy owners.

In our previous reports, the group of Rambler owners has been heavily loaded with such unfrivolous occupations as clergymen and accountants. There still are many teachers and engineers, but this year's group seems less conservative. As an example, there's the Texas industrial supervisor who says, "I am the proud owner of a sassy red-and-white Rambler American hardtop. Besides being economical and sturdy, it's also beautiful. Previous Ramblers looked too much like boxes on wheels."

Style demands its price, though. Rambler designers, wanting to get as much car as possible within the over-all dimensions had to keep the bumpers (without standard bumper guards) in close to the body both fore and aft. This didn't please some owners, including a sign painter for a Minnesota county highway department who comments: "Wish it had some kind of bumper guards; the headlights are too easily damaged as they're too even with the bumper."

From the beginning economy has been a watchword with Rambler buyers. But the idea may have been oversold. Owners have such high expectations that they're easily disappointed. A sample is the Kansas salesman whose 15 m. p. g. over-all was less than he expected, although he bought an optional 125-hp. engine and is pleased with the acceleration and speed he gets.

With the *PM* fuel meter and fifth wheel for precision, we obtained these steady-speed fuel figures:

At 30 m. p. h., 29.22 m. p. g.
At 40 m. p. h., 25.15 m. p. g.
At 50 m. p. h., 20.55 m. p. g.
At 60 m. p. h., 18.26 m. p. g.
At 70 m. p. h., 16.19 m. p. g.

Over-all mileage, including some stop-and-go city and more high-speed country driving, was 21.4 m. p. g.

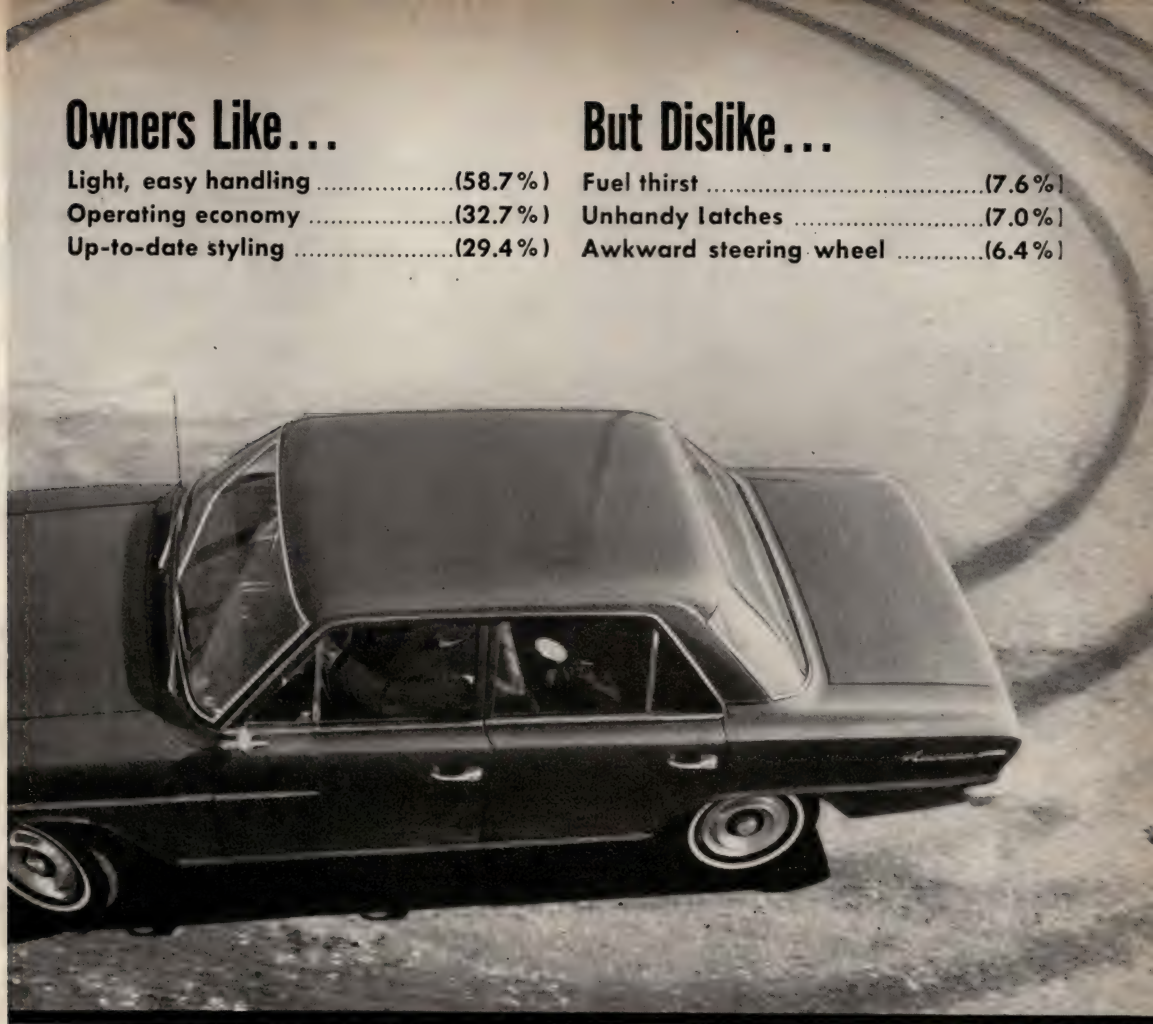
On performance, our test car (a model 440 with the over-

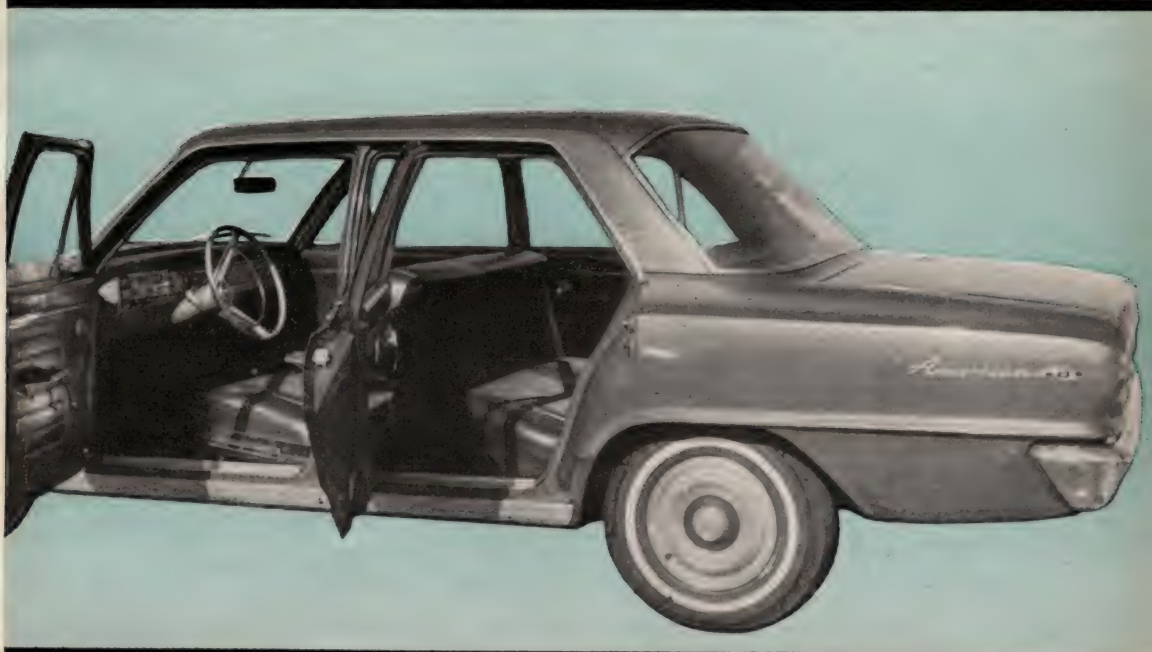
Owners Like...

Light, easy handling .....(58.7%)
Operating economy .....(32.7%)
Up-to-date styling .....(29.4%)

But Dislike...

Fuel thirst .....(7.6%)
Unhandy latches .....(7.0%)
Awkward steering wheel .....(6.4%)





CAN'T SOMEPLACE ELSE be found to stow the spare, asked some owners? Most found space about as expected—worthy neither of praise nor blame

HEADROOM IS ABOVE AVERAGE, even in rear. But owners who wear hats (and their number is decreasing) complain that 37½ inches still isn't enough room

AMERICAN'S HEATER-DEFROSTER system drew praise, but a few owners found they risked turning off headlights by accident, trying to reduce the heat

The American is no bomb, it's true, but you can pass the trailer trucks safely when you need to

One PM test driver felt Rambler's steering was too slow for a light car, at six full wheel turns lock to lock

What's more, those lines will keep on impressing people for years. The American's styling is the kind that wears well

head valve Six) averaged 13.8 seconds from standstill to 60 m. p. h., 6.8 seconds going from 40-60 and 8.7 seconds from 50-70 m. p. h. From a standing start, the quarter mile took 23.2 seconds and we were doing 73 m. p. h. at the end.

What do owners like most about their Rambler Americans? Letting the owners speak for themselves, here are the first five points they find worthy of praise:

"It handles so well, driving through rush-hour traffic is no longer worse than the day's work."—South Carolina sailor.

"Holds the road well for a small car."—New York sales manager.

"It handles easily in all conditions and is exceptionally good in snow and ice."—Ohio electrician.

"Excellent transportation for minimum investment, operation and maintenance cost."—Illinois professor.

"The clean, uncluttered lines impressed me first."—California keypunch operator.

"The '64 took my eye, so I traded in my '62."—California retiree.

"It has a generally neat appearance and you don't see so

many others on the road."—Alabama salesman.

"The car is small, easy to handle, yet large enough for comfort on trips."—Ohio factory worker.

"The wheelbase is short, making the car easy for my wife to park."—New York bus driver.

"It's very easy to park, very comfortable, and has plenty of room."—Massachusetts retiree.

Not all is love and kisses, of course. Here are the five most frequent complaints in the order in which they're listed by the American's owners:

"Would like better mileage than 16 m. p. g. over-all."—Missouri nurse.

"I don't go over 40 m. p. h., so I should do better than 15 m. p. g. over-all."—Florida production manager.

"I suspect that my low gasoline mileage is partly due to use in cold weather. Besides, the engine for the first 1000 miles was set to idle too fast."—Pennsylvania physician.

"The door lock is inconveniently located."—Illinois secretary.

"I have to kneel down to find the keyhole under the door handle."—retired Californian.

"The doors won't lock without a key."—New York salesman.

"It's difficult to get under the steering wheel with heavy winter clothing."—New York counselor.

"The steering wheel is in my lap. It hits bottom button of my coat."—New Jersey teacher.

"There's no headroom—I can't wear a hat in the car."—Ohio salesman.

"The rear seat is too high or the roof is too low."—New Jersey mechanic.

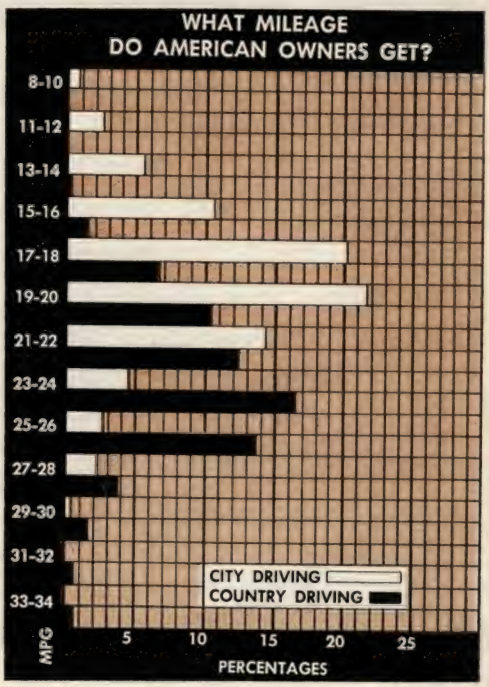
With proper tuning and reasonable driving she should be able to get 20 m.p.g., especially with overhead valve, 125 hp. engine

Keyhole is difficult to reach it's true, but that location also helps protect it from icing up

Position of American's wheel seems to have been dictated by location of parts rather than comfort of drivers

DRIVERS WITH SHORT LEGS can move the seat far forward, but they'll find the extended steering column leaves little room to spin the wheel

WITH MOST OWNERS getting 17-20 m.p.g. in town and 21-26 on the road, fuel-consumption disappointment can be blamed largely on extravagant ads



"Heater blower is very loud."—New York lawyer.

"Too much heater noise."—Illinois prison guard.

"The heater fan should have a lower speed."—South Dakota postal worker.

Following, again listed according to the frequency with which they were mentioned, are numbers six through ten of the praiseworthy features:

PM's tallest tester, 6 foot 2½ inches agrees but finds the steering wheel too close for long arms that match his long legs →

"It has a comfortable interior for my 6 foot, 3 inch frame."—Ohio pilot.

"Lots of horsepower (138 in this case) for a compact car."—California lift driver.

"The performance from my '61 Rambler sold me on another one."—Wisconsin millworker.

Few if any cars give you better vision than American →

"Ample power for six-cylinder."—Maryland restaurateur.

"I get a full view of the road."—California sanitarian.

"Driver's vision is fine, especially for someone like myself who wears bi-focal glasses."—New York teacher.

"The windshield wipers leave no blind spots."—Florida mailman.

Could be, but there's still room for improvement →

"It steers so much more easily than all my previous Ramblers. This is my fourth one."—New York painter.

"Pleased with steering and handling; it's easy to make U-turns."—New York welder.

Owners generally are loath to find shortcomings in their new cars. But here are numbers six through ten of their complaints, with the most common mentioned first:

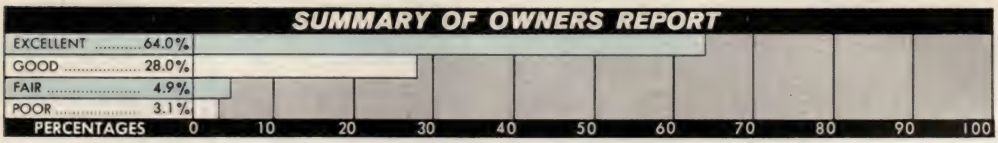
They should design split front seat so that right hand half would move forward as its back is tilted →

"Front seat back should tilt forward more in the two-door model."—Michigan engineer.

"Chipped paint and rust spots have developed."—Florida general manager.

(Please turn to page 198)

SUMMARY OF OWNERS REPORT



Fuel mileage	
About as expected	50.8%
Better than expected	19.5
Not as good	29.7
Best-liked features	
Handling ease	58.7
Economy	32.7
Styling	29.4
Riding comfort	25.7
Easy to park	18.3
Roominess	18.0
Power, performance	17.1
Compact size	15.0
Visibility	10.7
Specific complaints	
Poor gasoline mileage	7.6
Door locks	7.0
Steering wheel	6.4
Lack of headroom	6.1
Heater (inadequate or noisy)	5.5
Front seat won't fold (2 dr)	5.5
Inferior paint finish	4.6
Mechanical trouble, if any	
No mechanical trouble	31.8
Speedometer	3.7
Carburetor	3.0
Horn	2.8
Automatic choke	2.4
Best-liked exterior features	
Clean, smooth lines	10.1
Curved side windows	8.3
Neat, conservative design	7.6

Least-liked exterior features	
Curved side windows	4.3%
Inadequate bumpers	3.7
Rear end	3.1
Single headlights	2.8
Hood latch (hard to open)	2.4
Best-liked interior features	
Reclining or bucket seats	21.1
Comfortable seats	11.9
Dashboard	11.6
Upholstery	10.7
Heater, defroster	8.9
Headliner	6.7
Least-liked interior features	
Glove compartment	7.3
Dashboard	5.5
Parking brake	2.8
Recessed floor	2.8
Idiot lights	2.1
Transmission hump	2.1
Decision on Rambler influenced by:	
Economy	41.9
Price, trade-in	37.0
Styling	32.1
Previous Rambler ownership	28.4
Compact size	12.2
Import make considered, if any	
None considered	76.8
Volkswagen	16.8
Triumph	1.2
Fiat	0.9
Renault	0.9

Other compacts considered, if any	
None considered	46.5%
Chevrolet and Chevy II	17.1
Other General Motors makes	16.8
Ford Motor makes	28.1
Chrysler Corporation makes	11.3
Family's other car, if any	
One-car family	56.6
Another Rambler	13.5
Chevrolet	8.6
Other General Motors make	9.5
Ford	5.2
Other Ford Motor make	0.9
Chrysler Corporation make	4.6
Import	4.9
How is dealer service?	
Excellent	54.1
Average	35.5
Poor	10.4
Would you buy from him again?	
Yes, would buy	64.2
No, would not buy	13.5
Make of car traded in	
Chevrolet	10.1
Other General Motors make	11.6
Ford	6.1
Other Ford Motor make	4.0
Chrysler Corporation make	7.7
Would you buy another Rambler?	
Yes, would buy	83.2
No, would not buy	7.6
Undecided or don't know	9.2

Baby (When It's Cold Outside) Tows Cars

"Some motorists are pretty startled when they see an elephant come to their help," comments the owner of Baby, a circus elephant who earns her winter keep by serving as a tow truck for stalled cars.

Baby is a show business star in the summer and spends winters in the rear of an English service station. As the photos show, she's just as adept at carrying a can of gasoline as she is at towing.

Push-Pull Plane

Two 200-horsepower engines—mounted in the fore and aft ends of the fuselage—drive a new French plane at a top speed of 212 m.p.h.

The Jupiter Moynet 360, built by Engins Matra of Paris, carries five people. Service ceiling is 22,470 feet, and range is 1242 miles. It flies 158 m.p.h. on one engine.

Boat Trailer Expands into Campers' Living Quarters

Capable of carrying a 16-foot boat when used as a boat trailer, a new camper converts into an 80-square-foot room with built-in sleeping space.

When closed, the unit is eight inches deep, with inside storage for cots, bedding, table, chairs and fishing gear.

The Skippers Inn is made by Right Products, Inc., 213 Dunn St., Cincinnati 15, Ohio. Price of the unit is $795.

Pro Tricks from a Water-Ski Champ

Wave-top hair raisers are easier than you think!

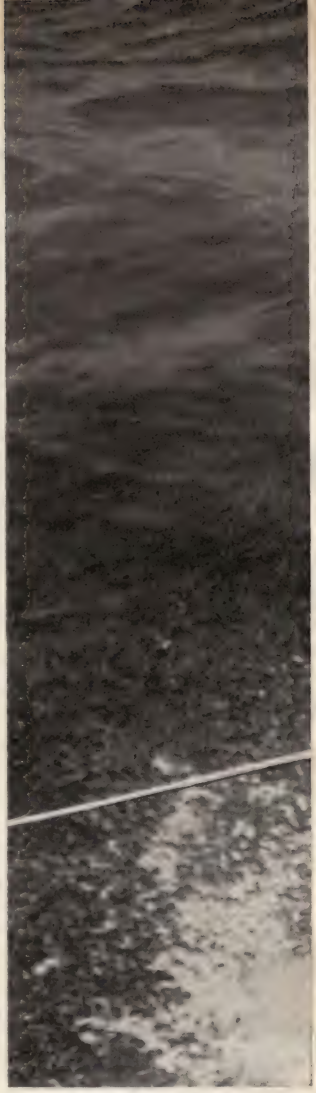
By Al Tyll, 1963 Masters Trick Skiing Champion

IF YOU HAVE THE BALANCE to ski on one ski and jump the wake behind a speeding tow boat, you can become a trick skier. All it takes is the knowledge of a few basic techniques, a special water ski and a lot of perseverance.

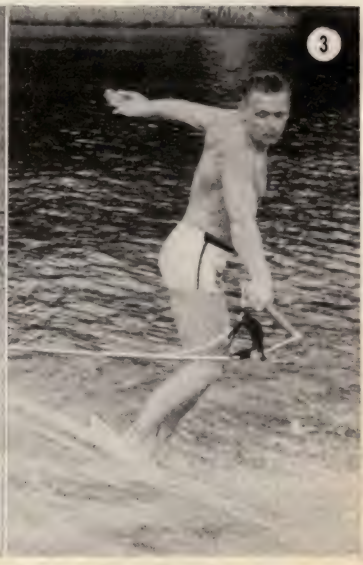
The special trick ski is about 20 inches shorter than a regular water ski and is canted from the middle to both ends. It has a smooth bottom for easy side sliding (photo, page 115).

There are actually only two basic techniques needed for trick skiing, the vertical crouch and the upward bounce. You must go into the "vertical crouch" preliminary to all stunts; simply bend the knees and waist and keep the shoulders and head erect. The arms are straight and the skis are parallel, with the tips just peeking out of the water. The bounce is nothing more than going into a momentary deep crouch and then leaping straight up. This unweights the skis, takes them clear of the water, and your actual turns are made in the air.

The tow rope for a beginner should be about 75 feet long, and the speed of the boat between 16 and 18 miles an hour.



HELICOPTER: Skiing to the left of the boat's wake, you go into the crouch preparatory to this trick. With the left hand, pull in the tow handle and pass it to the small of the back. Take the handle in the right hand. This is the wrapped position (1). When certain of your balance, bounce down, then straight up. The skis will be clear of the water and the pull on the rope will begin to spin you (2). Coming all the way around (3), pull in on the tow rope and bend the knees (4) to take up the shock of your landing



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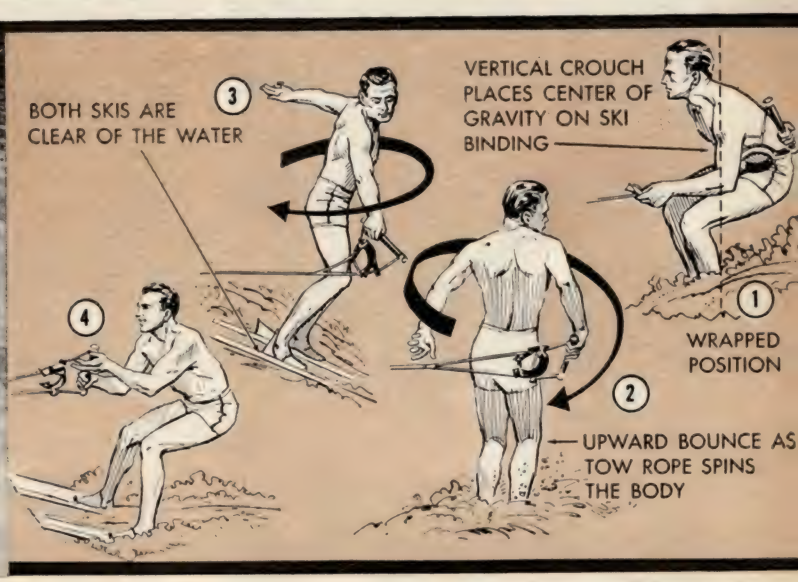

VERTICAL CROUCH PLACES CENTER OF GRAVITY ON SKI BINDING
1
WRAPPED POSITION
2
UPWARD BOUNCE AS TOW ROPE SPINS THE BODY
3
BOTH SKIS ARE CLEAR OF THE WATER
4

Two-Ski Step-Over on the Water

This is a spectacular stunt that looks harder than it is in reality. The first few times you might spill backwards, but when you get the knack of compensating for the pull of the tow rope, you'll have success.

Begin by skiing directly in the wake of the boat. Assuming the vertical crouch, hold the tow handle with the right hand and release the left arm for balance. What follows now is a single smooth movement that takes about two seconds.

As you dip into a deeper crouch preparatory to the upward bounce, your weight is placed on the left ski. Beginning the upward bounce (1), the tip of the right ski is clear of the water. The tow rope must be held as low as possible. As you bounce upright, the right ski is kicked into the air and over the tow rope. With the body on the rise the left ski is momentarily unweighted, allowing it to pivot (2). As the right ski comes down (3), you crouch forward, returning the weight to the left ski until the right ski hits the water (4). The procedure is simply reversed to return to forward position.

Wake Toe-Hold Turn-Around

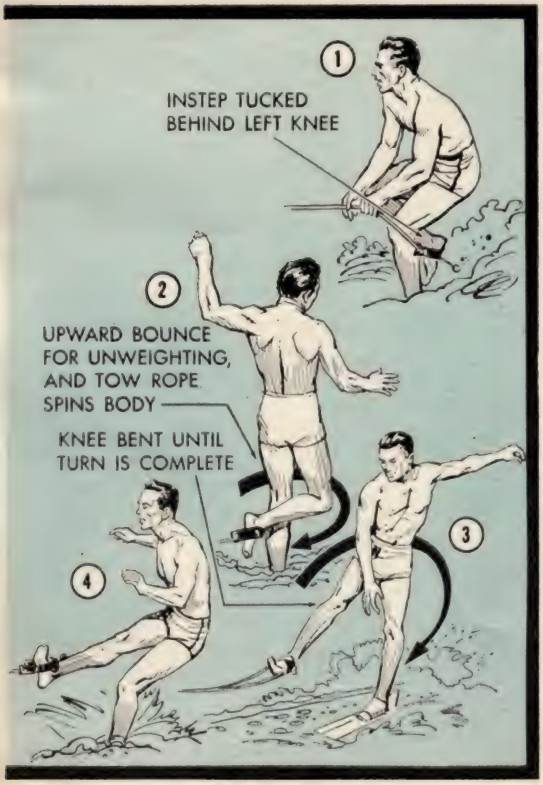
Mastering this stunt requires practice, but don't let the first dozen spills discourage you. It can be done.

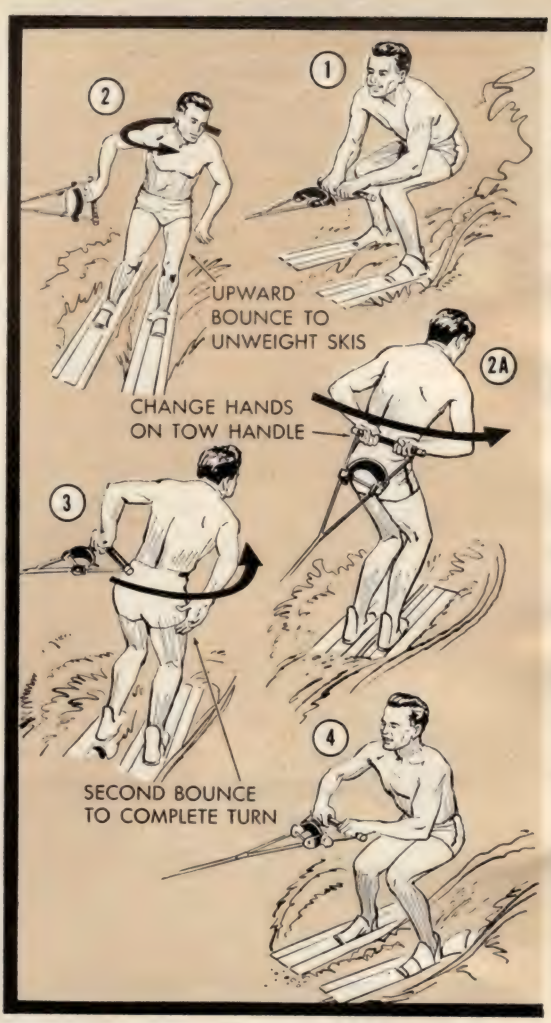
Skiing to the left of the boat's wake on one ski, assume the vertical crouch and pull in on the tow rope. Pass the toe hold handle on the outside of the left leg and slip the instep of the right foot into the harness (1). The ankle of the right leg is tucked behind the knee of the left leg. With the knee taking the pull of the rope, angle across the wake.

Crouch deeply as you hit the wake, then bounce straight up, arms high and outstretched for balance and swinging to the right.

Bouncing off the wake you will be about eight inches in the air. The pull on the tow rope will spin you around (2 and 3) while you're still airborne, and you will land facing the boat (4).

It is important in this stunt to keep the rope knee bent until landing to absorb the shock of the ski returning to the water. At completion the leg is outstretched and the body canted backwards against the pull.





Turn-Around on Two Skis

Making a full 360-degree turn on the water is simply executing a double bounce.

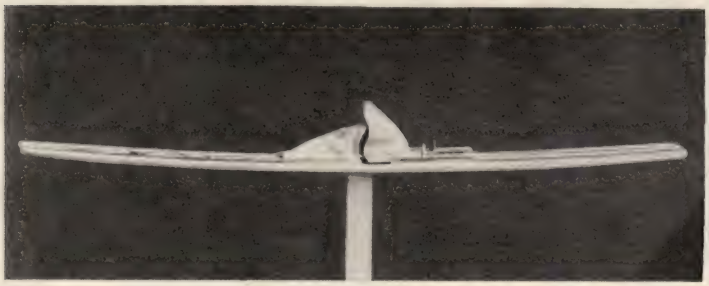
Skiing directly behind the boat with the weight equally distributed on both skis, you assume the vertical crouch (1).

As you bounce upward, release the left hand. The weight is off the skis, reducing the drag and allowing them to turn easily (2). It is important to always keep the handle close to the body, and the head erect. At the halfway mark (2A above) the handle is in the small of the back, being passed to the left hand. The weight is coming down on the skis, and the body is leaning forward to raise the tails of the skis.

There is another upward bounce to unweight the skis, the handle is in the left hand (3), and the turn is completed (4).

SIMPLE, but important, the toe-hold handle designed specifically for trick skiing is a leather harness that distributes the tow rope pull over the instep

SIMULATING the pull of a boat, a 40-pound block on rope and pulley allows the author to practice the jumps and turns in his yard during off-season days



SMALLER than regular water skis by about 20 inches, the trick ski is canted up on both ends for maneuverability in either direction. The keel has been eliminated to facilitate side sliding. Blunt on both ends, the trick ski is rigid to maintain a constant rotating axis. The rubber bindings are adjustable, and for stunts they should be snug, but not too tight

BOAT DRIVER, observer and skier must work as a team. To facilitate communication between skier and driver, the American Water Ski Association has devised a set of hand signals (below) that are now used universally

New for Your Home

AUTOMATIC POOL COVER *features translucent fiberglas panels. When pool is in use, a ¾-hp. motor raises twin covers to form sun protection on either side of pool. Unit in many colors and sizes costs from $1495 to $2500. Made by La Cienaga Const. Co., Los Angeles, Calif.*

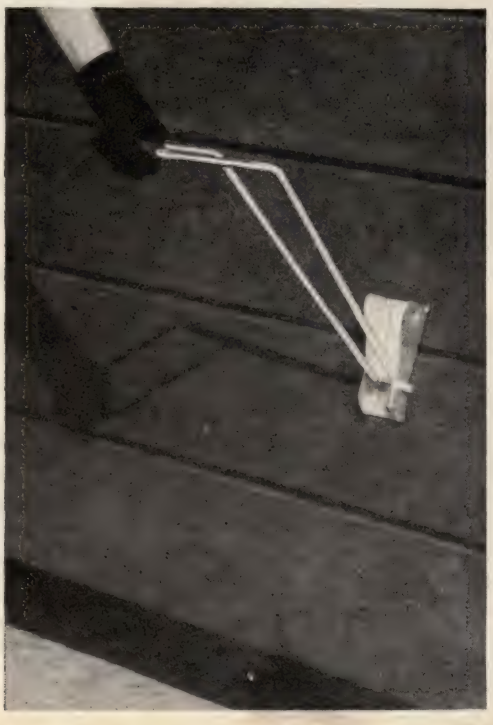
GRIDDLE AND GRILL *built-in range operates electrically, provides a cook-out in your kitchen. Griddle replaces grill to handle batch of pancakes. Stainless or enamel units are 2¾ inches deep with removable parts. Price: $218.50. Thermodor, 5919 District Blvd., Los Angeles, Calif.*

ROLLING GARDEN SEAT *11 inches from the ground lets you weed, plant or cultivate without stooping or kneeling. 15 by 15-inch vinyl surface, aluminum frame and handy tool shelf comprise unit. Assembled, it's $17.95 from Wissings, 5851-16th St. N., St. Petersburg, Fla.*

BOTTLE CAP REMOVER *uses leverage principle, pries open any bottle cap with ease. Powerful magnet holds onto cap after it's removed. Of forged steel with a rubberized handle, the item is two dollars postpaid. By Hollis Company, Dept. PM, 1133 Broadway, New York 10, New York*

PLASTIC SPRAY *coating stiffens fabric into window shades, place mats, wall coverings. Harmless to delicate materials, spray eliminates need for dipping or sewing fabric edges. One 22-oz. can makes 2 average shades. $2.98, Fair Exchange, 21-70 River Road, Fair Lawn, N.J.*

GARAGE DOOR HANDLE *makes heavy doors swing open easily, allows positive one-hand control. Handle fits all overhead garage doors and locks into place when not in use. Quickly installed, $3.98 each. House of Manhattan, Dept. Z-1, 1701 Harkness St., Manhattan Beach, Calif.*



Concrete Sections Form Geodesic Dome

Hollywood's new Cinerama Theater is believed to be the world's first concrete geodesic dome. It consists of 316 pentagonal and hexagonal precast sections weighing up to about three tons each. Previously, geodomes were made of lighter materials like plywood or plastic. Photo above shows completed theater. At left, a crew lowers a precast section into place.

Eye Watchers

As his eyes follow a moving target, a photo-electric cell in this researcher's eyeglasses records and transmits information from an eye and ear infirmary by wire to a computer for analysis.

The special eyeglasses were developed at Massachusetts Institute of Technology for a close study of eye movements.

Newspaper Spray

A new spray gun makes it possible to insulate a house with old newspapers. The papers are ground up and fireproofed with boric acid. When sprayed on the wall, they pass through a mist of adhesive which binds them in place. The process was developed by U.S. Insulation Sales Co., 2306 Edwards St., Houston, Tex.

Brief Case Turns Steering Wheel into Writing Desk

For salesmen and businessmen on the move, a brief case can be attached to an automobile steering wheel to serve as a writing desk.

Made of leather and zippered on both sides, the case is large enough to carry papers and samples. In the automobile, one side is unzipped and the case fits over a standard steering wheel. When the other side is unzipped it reveals a writing board with metal clips for holding papers.

The car deck is made and sold by Regency Covers Ltd., 169 Great Portland St., London, England.

Portable Radar

Foxhole GIs can now spot small targets with a hand-carried radar unit. The eight-pound instrument can identify, by means of characteristic signals, people, animals or vehicles up to two-thirds of a mile away. With audio, the General Dynamics unit can be used for communication with close-support aircraft or ground vehicles.

Bubble-Touch System

Eliminating fingertip fatigue, pneumatic bubbles fitted on typewriter keys will make life easier for the working girl.

According to the inventor, a Frenchman named M. Jacquignon, ordinary typewriter keys tire a typist's hand by exerting pressure from skin to nails. His "covertip" will eliminate this pressure.

What's So Tough About MOWER REPAIR?

That balky midget power house can thwart your mechanical prowess—unless you learn a few new tricks

By Morton J. Schultz

SO MY POWER MOWER quit on me. I wasn't too concerned, since I've been working on cars for years. What mysteries could a lawn mower engine—with a carburetor only 4 in. long—hold for a mechanical wizard like me? So I went for my wrenches.

Today, my mower's in a repair shop. It'll cost me $14 to get it out of hock—and meantime my lawn is getting to look like a fertilized cow pasture. The repair man told me—rather smugly, I thought—that if I'd brought it to him in the first place, he could have fixed it for $5.

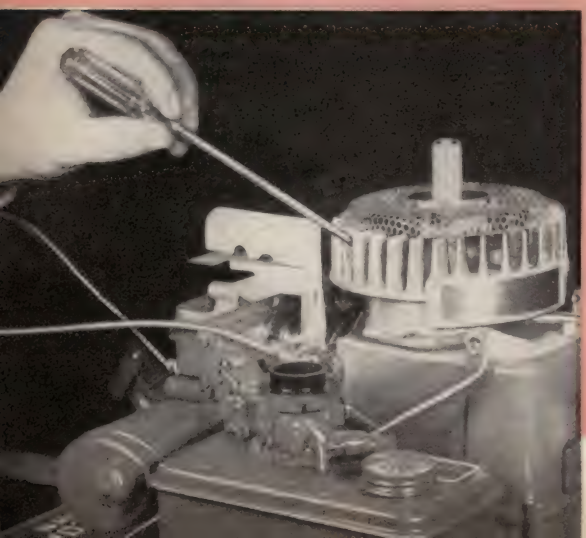
The moral of this sad tale isn't (despite what *he* thinks) that power mower repair must always be done by a pro. Instead, it's that a do-it-yourselfer should realize his mower engine isn't just a simplified version of the one under his car hood. You could be the hottest auto mechanic in town and still be baffled by that dinky two- or four-cycle power plant. Consider these three points:

- A car's engine allows you a certain amount of tolerance in adjustment of any part. A little error isn't too critical. And there are six or eight cylinders, so if one fails, the car still runs.

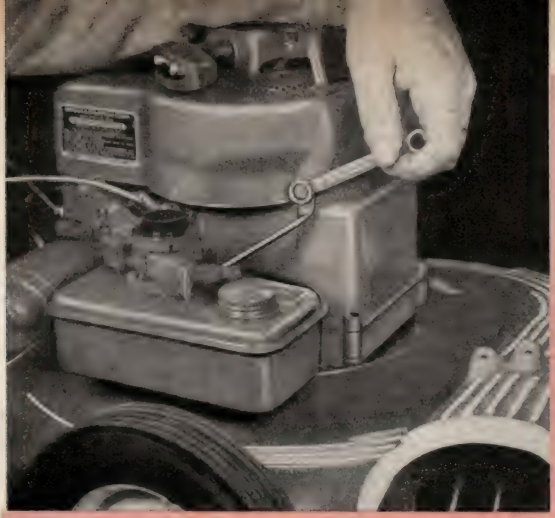
With a power mower engine, everything is measured to the thousandths of an inch. If you're off by even that much, the engine may run rough, if you're lucky, but probably won't run at all. And there's only one cylinder. If that fails, you've had it.

- The compactness of the engine makes

DIG BETWEEN FINS with stick, brush, or screwdriver to loosen clogged debris that can raise engine heat



REMOVE SPARK PLUG to check for failure of fuel or ignition systems. When replacing, don't overtighten



REMOVE BLOWER HOUSING to clean between fins. Most housings are held in place by only three bolts

HOUSING LIFTS OFF after bolts are removed. Slip bolts in envelope or button-flap pockets to avoid loss

for an odd arrangement of parts that can confuse anyone without training in small engine repair.

● Since the engine differs from a car's, troubleshooting must be relearned. Yet once you do learn to diagnose what's wrong, you'll recognize the repairs you can easily handle yourself, thereby saving yourself needless trips to a repair shop.

"Of the mowers we get in for repair, 50 percent of them have only a *minor* problem that anyone could fix with a screwdriver or wrench," says Charles Kennedy, co-owner of Kennedy's Fixit Shop in Somerville, N.J.

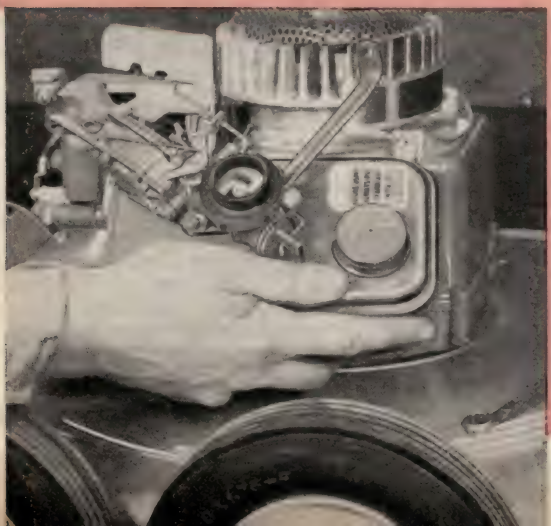
If fifty-fifty odds that you can save a repair bill sound good enough to prompt you to learn small-engine basics, read on.

As with any gasoline engine, three conditions must be present for your mower's engine to run: fuel, fire (in the form of a spark) and compression. If any one is missing, the engine's dead.

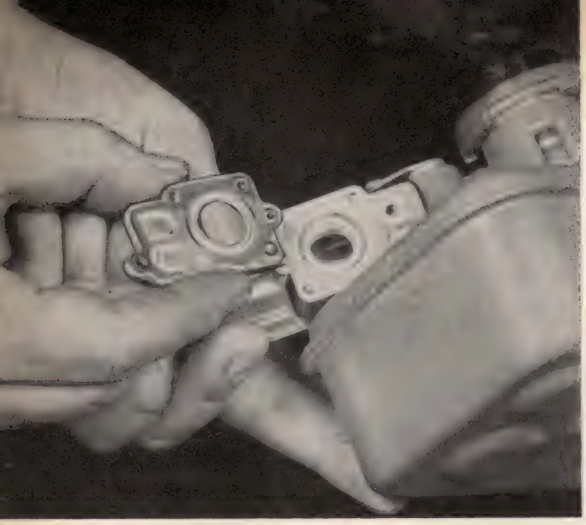
But your mower's power plant is more susceptible to dirt and overload than other gasoline engines. After all, it comes into contact with dirt and foreign matter (grass) at every turn of the shaft, and it generates relatively little horsepower—anywhere from 1½ to 3.

Since the most common mower complaint is that it won't start (or, once stalled, won't *re*-start), we're going to concentrate on that problem, here. The five other things that could hamper efficient engine operation are summed up in the

DIAPHRAGM CARBURETOR acts like a car's fuel pump to draw gas from fuel tank combined in same unit

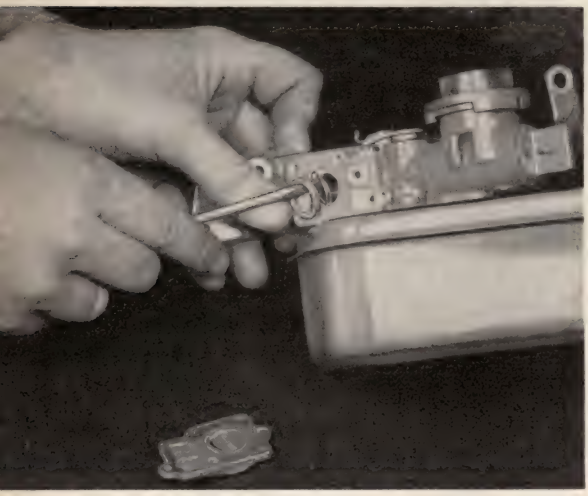


NO FUEL LINE is needed since gas is drawn directly from tank by these pipes, capped with fuel filters



RUBBER DIAPHRAGM of carburetor is replaced by unscrewing cover plate, slipping old ones out, new in

DIAPHRAGM SPRING may have lost tension. If so, replace it at same time, while cover plate is off



ELEMENT TYPE AIR FILTER sets on top of carburetor, sifts dirt out of air drawn in to mix with the fuel

troubleshooting chart at the far right.

Although they look much the same, there are variations in different makes of lawn mower engines. To familiarize yourself with your mower's engine, consult the manual that accompanied your unit when you bought it. If this has been lost, get a replacement by writing to the company that makes your mower's engine, giving them the model number you'll find on the engine nameplate.

For safety's sake, before you touch your mower, disconnect the ignition wire from the spark plug. With this done, it won't matter if you have your hand in the wrong place—the machine can't start.

When your mower gives you trouble, the following are the areas that any homeowner should be able to check and they are listed in the order that you should check them. Remember that a logical troubleshooting sequence must be observed. These troubleshooting procedures hold true for both two- and four-cycle engines, except where noted.

Stalled Engine Won't Start

Let's assume, first, that your mower caught right off, performed well for a time and then abruptly stalled. Nothing you try will persuade it to restart. Save your choicer cuss-words until you've checked for the following:

- **Vapor lock.** This condition is the result of excess heat around the engine. Remember that you're dealing with an air-cooled engine, and any dirt or foreign matter which restricts the air flow contributes to a heat buildup.

Remove the blower that covers the cooling fins and clean all dirt, grass or debris from between the fins and wherever else it's packed.

On two-cycle engines only, heat buildup can also result from clogged exhaust ports. These are usually covered by an alloy cover and screen on the bottom of the engine. Remove the cover and screen and clean the ports. (This should be done periodically anyway.)

No Start After Storage

Suppose you go to start the engine for the first time in several days and it refuses to kick over. Generally you can look for the cause in either the fuel system or the ignition. But which one?

There's a test that professionals perform to find out. Give the flywheel several cranks with the choke closed to insure that a heavy concentration of fuel will enter the cylinder if, in fact, the fuel system is in good working order. Remove the spark plug and feel it. If the plug is wet with gas, there must be an ignition break-

down. Fuel is getting to the chamber, but isn't igniting. If the plug is dry, there's probably a stoppage in the fuel system. An exception: On older mowers, the carburetor needle-valve may be too tightly closed to let enough gas flow through; so open the valve a turn or two and try starting the engine. This is usually not the case with new mowers. The needle valve is preset at the factory and should never be touched, unless you inadvertantly move it.

If you're faced with an apparent fuel system failure on a recent model, therefore, there's a more likely cause:

● **Dirty and plugged fuel parts.** Remove the gas tank, fuel line (if you have one) and carburetor. One or all three might be plugged with dirt and gasoline-deposited varnish. If a fuel line is present, inspect it for crimps and cracks, and replace it if it's damaged.

Wash the tank, fuel line and carburetor thoroughly in engine degreaser (the pros often call it gunk), paying attention to the fuel filter. In some engines, this fuel filter is found on the bottom of the tank. If your mower contains a tank filter, you'll see an adapter assembly screwed into the bottom of the tank into which the fuel line is connected.

It would be wise to replace a filter of this type, if it hasn't been changed for some time. You can buy the adapter and filter as a single unit. In screwing the new unit into the tank, make sure the installation is tight, to prevent leakage.

In other model mowers—those without fuel lines—the filters are part of the fuel pipes extending from the carburetor into the fuel tank. These should be cleaned thoroughly with gunk.

Let all parts soak for an hour or two in gunk, which dissolves varnishes and gum. Then, wash them in water and dry with air from an air pressure hose, which also serves to blow away dirt and sludge.

Do *not* disassemble the carburetor unless you're fortunate enough to have a simple unit that contains only a few parts. In complex diaphragm-type units, the only thing you should attempt is replacing the diaphragm. It's possible that this part has ruptured, preventing a flow of gas from the tank into the carburetor.

An important aspect of fuel system service is the air cleaner. You could have either an oil-bath or element type. The latter is shown in the photo lower left. If it's an oil bath type, dump the old oil and clean the assembly in gunk. Then refill to the level mark with clean oil—SAE 20 or 30 is usually recommended.

Do not fill above the level mark. Too much oil in the air filter can cause the liquid to be sucked into the engine, where

OTHER ENGINE PROBLEMS

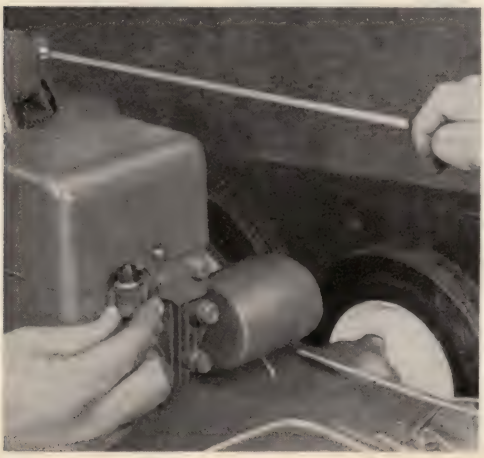
PROBLEM	PROBABLE CAUSES	CURES
ENGINE MISSES	*Incorrect spark plug gap	Regap plug (.020" is generally recommended)
	*Loose connection in ignition wire	Make sure wire is tightly connected to plug
	*Incorrect carburetor adjustment	Reset needle valve
	*Faulty choke setting	Reset choke to provide richer or leaner mixture, as needed
	*Water in gasoline	Drain old gas and refill with new
	Worn ignition wire	Try to patch or replace
	Poor spark	Check ignition system
	Points worn or pitted	Replace
ENGINE RUNS ROUGH	*Carburetor adjustment too rich (flooding)	Reset needle valve
	*Choke improperly set	Reset choke to provide leaner mixture
	Governor incorrectly adjusted	Readjust
ENGINE KNOCKS	*Low octane gasoline	Drain gas and use a better grade
	*Heavy load on engine operating at low speed	Increase engine speed if possible
	Carbon or lead deposits in cylinder	Purge cylinder of matter
	Spark too far advanced	Retime ignition
	Connecting rod bearing loose or burned out	Tighten or replace
	Piston pin loose or worn	Tighten or replace
ENGINE BACKFIRES	*Dirt, water or gum in fuel system	Disassemble system and clean
	*Low grade gasoline	Drain gas and use a better grade
	*Spark plug too hot	Switch to a colder plug
	Inlet valve sticky (4-cycles only)	Disassemble and clean or replace
ENGINE OVERHEATS	*Oil low in crankcase	Replenish
	*Carburetor adjustment incorrect	Reset needle valve
	*Low grade of gasoline	Drain gas and use a better grade
	*Air circulation around engine restricted	Clean fins and associated areas
	*Crankcase oil dirty or improper grade	Drain oil and refill with correct grade (SAE 20 or 30 is generally recommended)
	*Engine operating under heavy load at low speed	Increase engine speed if possible
	*Exhaust ports restricted (2-cycles only)	Clean them out
	Engine out of time	Retime
	Carbon deposits in engine	Purge cylinder of matter

*Repairs you can probably do yourself.

DISASSEMBLE AIR FILTER and wash it in degreaser; when clean, saturate the element with engine oil

NEEDLE VALVE regulates gas flow to carburetor. To adjust, turn it in snug, then back it off 1½ turns

IGNITION TEST: pull plug from socket, hold it on cylinder head bolt, crank engine. Get a fat spark?



it leads to a pressure buildup that can be at the root of a no-start problem.

● **Improper fuel-oil mixture** is the cause of some 80 percent of all troubles with *two-cycle* engines. The correct mixture calls for ½ pint of oil to a gallon of gasoline. The oil should be SAE 30 or the special type made specifically for two-cycle engines and sold at gasoline stations and home supply outlets.

If there is insufficient oil mixed with the gas, there will be insufficient lubrication of engine parts. These parts will overheat—and can seize.

If there is too much oil in the mixture, the engine will smoke and lose power. Furthermore, excess oil will lead to spark plug fouling—a major cause of no-start.

If your test revealed a gasoline-wet spark plug, then your problem is probably with ignition. But it could be that the engine is flooding, if the needle valve had been tampered with. So, first reduce the amount of fuel flowing into the cylinder by screwing in the valve until it is snug. Don't tighten it too much—you could strip it. Then, open it about 1½ turns, which is the proper adjustment for most mower carburetors. Dry off the plug and try starting the engine. If it still doesn't start, look to the ignition system:

● **Bad plug.** Don't take chances—if the plug hasn't been replaced for some time (100 operating hours is usually the maximum you'll get from it) or it looks bad, replace it.

If the engine still doesn't start, the trouble's probably somewhere in the rest of the ignition system—points, condenser or coil. Getting at these parts is a major job—the flywheel must be removed. So, you had best make sure that the trouble is with the ignition. Run the tests shown in the photos on these pages.

If you find a frayed or damaged wire, you might be able to patch it with insulating tape. If not, you'd have to get at the coil to replace it; in some machines, this means removal of the flywheel—a job for a pro, unless you have special tools. Sometimes, the wire is attached to the coil by means of a connector, so you can replace the wire and leave the coil in place. In other mowers, the wire is molded to the coil and to change it you must replace the coil as well.

● **Poor compression.** If you have no compression gauge, you can turn the flywheel by hand with the spark plug in place. When compression is sound, the flywheel springs back sharply when pressure on it is released. Lack of compression generally indicates one or a number of conditions—cylinder out of round, broken rings, broken connecting rod or, in four-

cycle engines only, a stuck or burned valve. Whatever it is, only someone with the proper tools and training would be well advised to attempt the repair.

Rotary lawn mowers have a tendency to fail, compression-wise, faster than reel-type mowers, because rotaries are usually operated at full power. A maximum of three years is the expected life of a rotary mower engine, while reel type mowers seem to last indefinitely. You never need full power to get a reel to cut. Instead of whipping off the grass—which takes more power—the reel type uses the familiar scissor principle.

There is one other thing which could damage rotary-type mower engines severely, and that is—

● **Vibration.** The chief cause of vibration, which could tear a machine apart, is an out-of-balance blade. This results when you regrind only one end of the blade.

When a blade needs to be reground, make sure the same amount of metal is ground off *both* ends, although one might appear to be in perfectly good shape.

To test the trueness of the blade, insert a screwdriver in the center hole. If it tips more toward one side than the other, you should grind off more metal on the heavy side or—if the imbalance is too bad to correct—get a new blade.

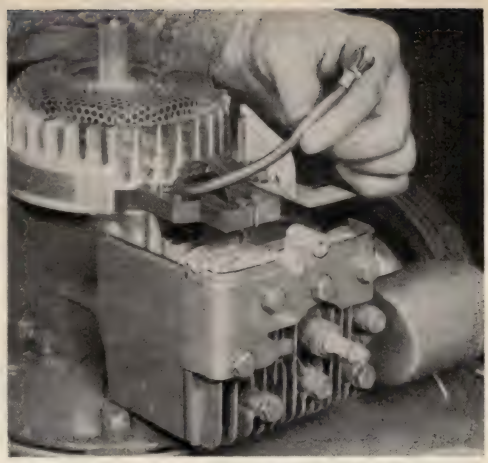
Engine Stalls in Grass

Finally, suppose your mower starts and runs smooth—until you push it into the grass. Then it stalls and won't restart. Your problem?

● **Engine overload.** There's probably nothing wrong with the engine. It's just not powerful enough to handle the load. A 1½ horsepower two-cycle engine, for example, cuts nicely as long as the grass isn't over 1½ inches high. Once you impose a stiffer load, the engine may quit.

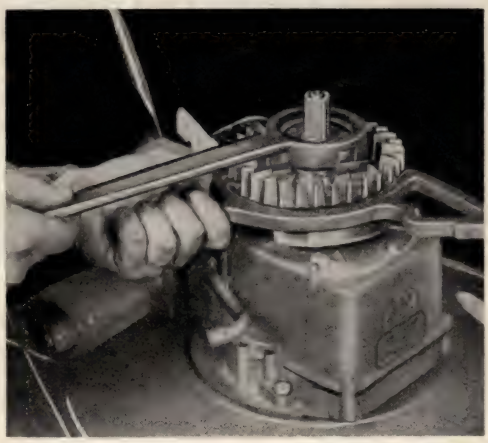
To determine whether your trouble is, in fact, engine overload, place the mower on a sidewalk or driveway and attempt to start it. If it starts and runs smoothly, you know there's nothing wrong with the machine. You just need one that generates enough power to handle the load. The solution? If your neighbor has a more powerful model, borrow it for the job just this once—and be careful, in the future, to schedule your mowing so that grass doesn't get longer than your own machine can handle.

Grass packed beneath the mower can also cause an overload condition. Perhaps the deck of the machine is too low and all the grass isn't being tossed out. Instead, it ravels around the shaft and blade. The solution, here, is simple. Just turn the machine over and clean it. ★★★

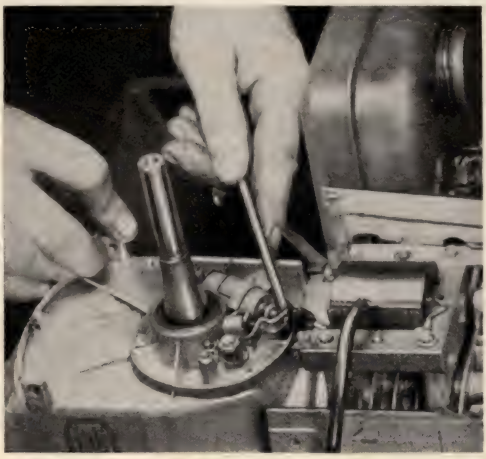


IF NO SPARK, check ignition wire. On engine above, bad wire is replaceable without removing flywheel

WHERE FLYWHEEL must be removed for a repair, use special wrench set to avoid damage to crankshaft



FLYWHEEL REMOVED, you're able to test points, condenser and coil to find which units need replacing



Miss Take

From prop to servos, all the gear in this sleek air-driven hydroplane is directly interchangeable with that of a radio-controlled airplane model

By Gerald C. Leake

IT STARTED WITH a plane crash. There comes a time in every radio-control flyer's life when he has the urge to say the heck with planes and try something that won't turn into a pile of broken balsa chips at the first minor malfunction. It was at just such a time that *Miss Take* was born.

You'll find numerous advantages in an air-driven boat. It's easy to start, requires no complicated system of water cooling, uses conventional airplane propellers and doesn't load the engine when placed in the water. In short, the maintenance problems are mainly those of an R/C airplane.

The prototype used six channels, but you can get along with four if you're willing to forego the air rudder as a back-up steering system. At low speeds, this rudder doesn't function as well as the water rudder, but it's sufficient to bring the boat back to shore if the water rudder becomes fouled. At full bore, however, it's extremely effective—enough to flip the boat if you aren't careful, so be sure to drop back to half-throttle before trying it.

The fuel tank holds better than 10 oz., enough for a 10-min. run at low throttle with a KB-45. You can use any engine from a 19 up to a 45 in *Miss Take*. Anything larger than 45 is impractical, since the chances of flipping increase rapidly at this point.

Construction of *Miss Take* is detailed on the following pages. Few special instructions are required to supplement the drawings. Just be sure to install the planking sheets with the grain running abeam of the hull.

When making the fuel tank, cut cross-

DOUBLE RUDDER SYSTEM is clearly shown in this stern view of *Miss Take*. Air rudder serves as a low-speed backup to water rudder, is most effective at high speed

wise slits for the tubing instead of drilling holes. Bend up the sides of these slits, and you'll find that you have a much larger soldering and bonding area between the tank and tubing.

After you have completed the tank, connect a length of neoprene tubing to the fuel pickup, emerse the tank in water and blow into the tank through the neoprene tubing while holding your finger over the breathing tube. If you see any air bubbles, note the location of the leak and resolder that area.

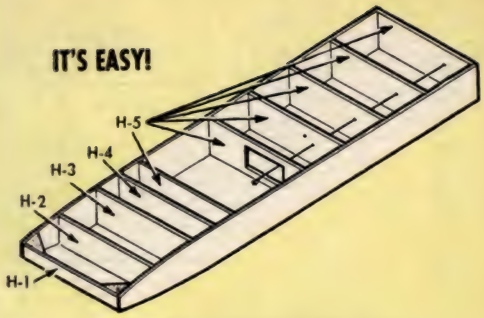
Should you discover a leak after installing the tank in the pylon, it's possible to correct it without breaking up the pylon. Just drill a small hole in the top of the pylon and pour in a little waterproof glue every day for a week. At the end of that time, the tank will be completely encased in glue so it *can't* leak.

After sanding the hull, glue the pylon in place on the centerline of the hull. To be sure of locating it exactly on this line, mark the location with a pencil and measure from each side of the hull to the ends of the pylon before gluing in position. Exercise the same care when mounting the ¼-in.-sheet keel rudder on the centerline of the boat.

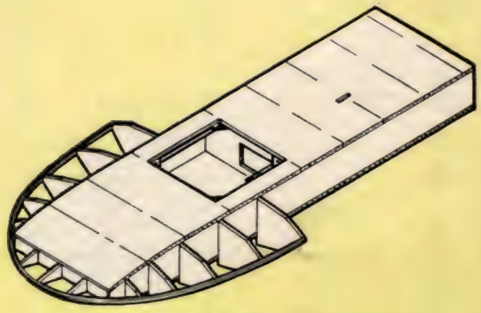
Make the water-rudder hinge by running a short piece of ⅛-in. wire through 5/32-in. landing-gear mounting straps. Solder a washer on each end of the wire after the straps are installed.

Only one screw is used to hold the crank for the water rudder in place. Thus, by loosening this screw and shifting the rudder, you can make small trip adjustments without taking the hatch off to gain access to the servos. Use a lock washer on this screw to ensure that it won't come loose during a rough run.

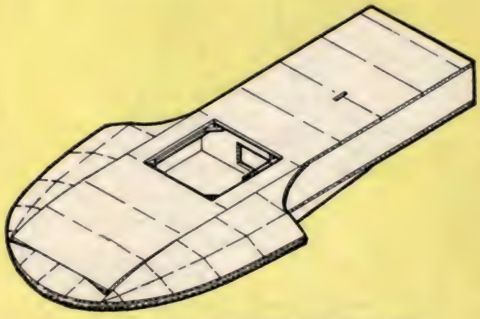
IT'S EASY!



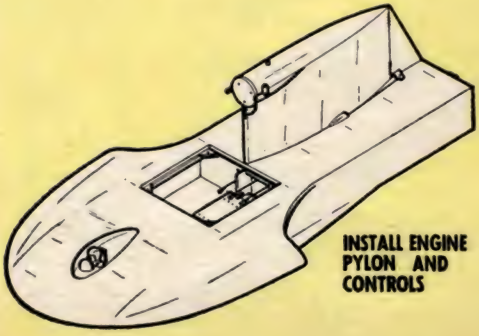
BUILD THE BOX-FRAME HULL



PLANK HULL AND ADD SPONSON FRAMES

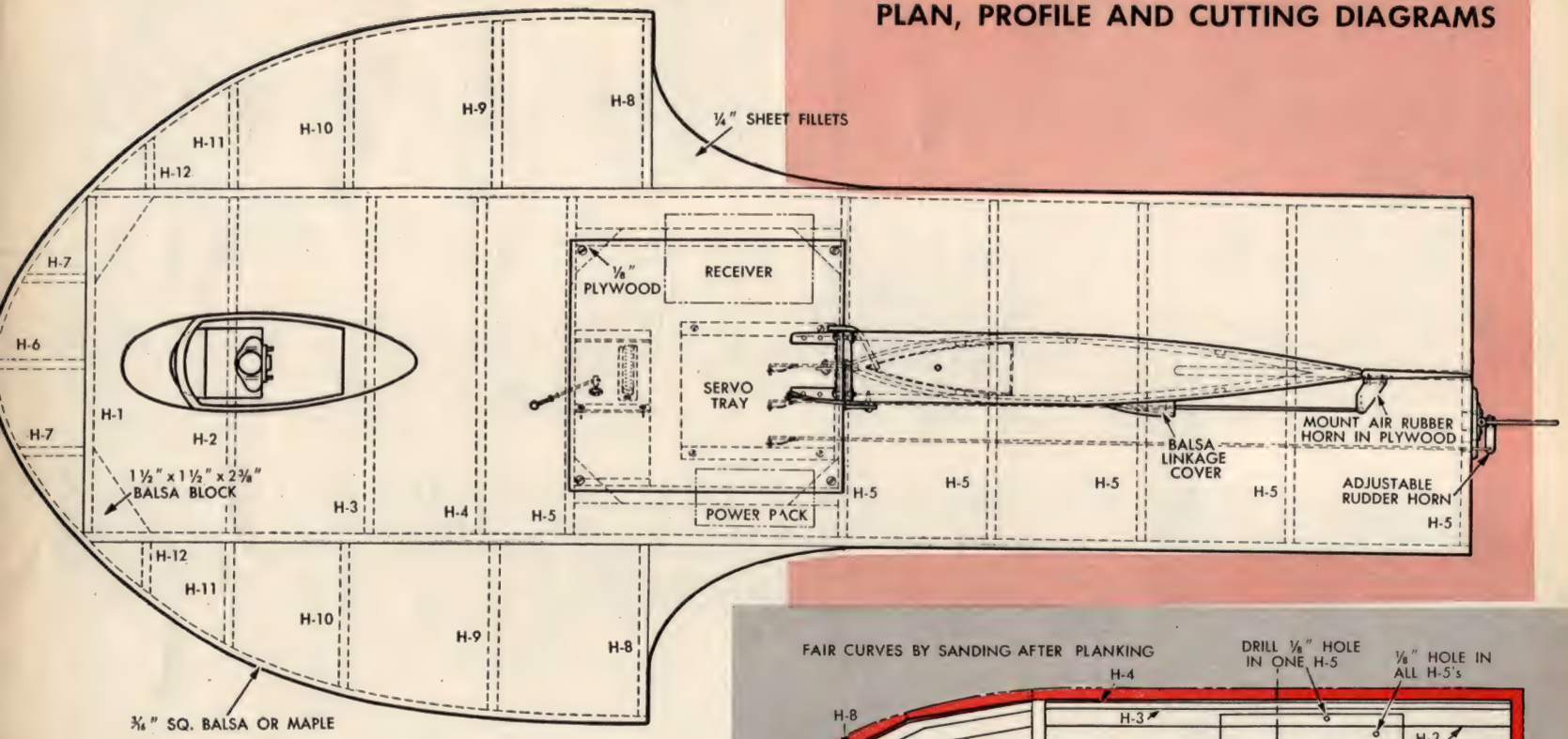


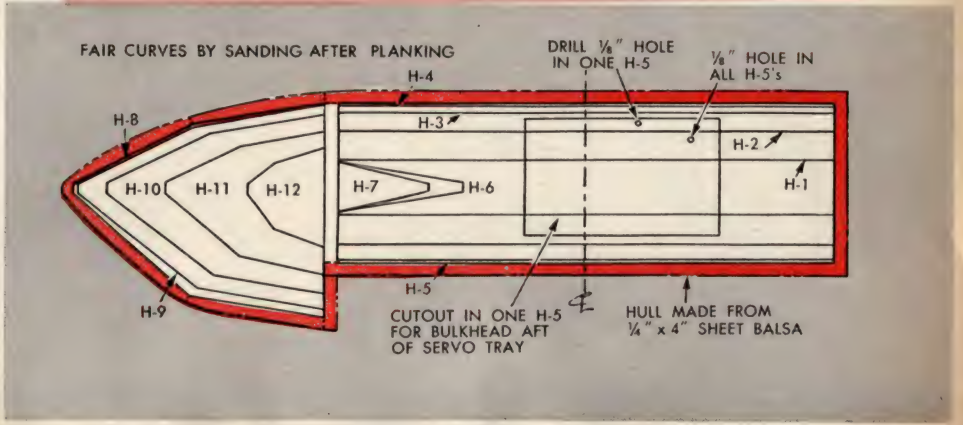
COVER SPONSONS AND SAND HULL



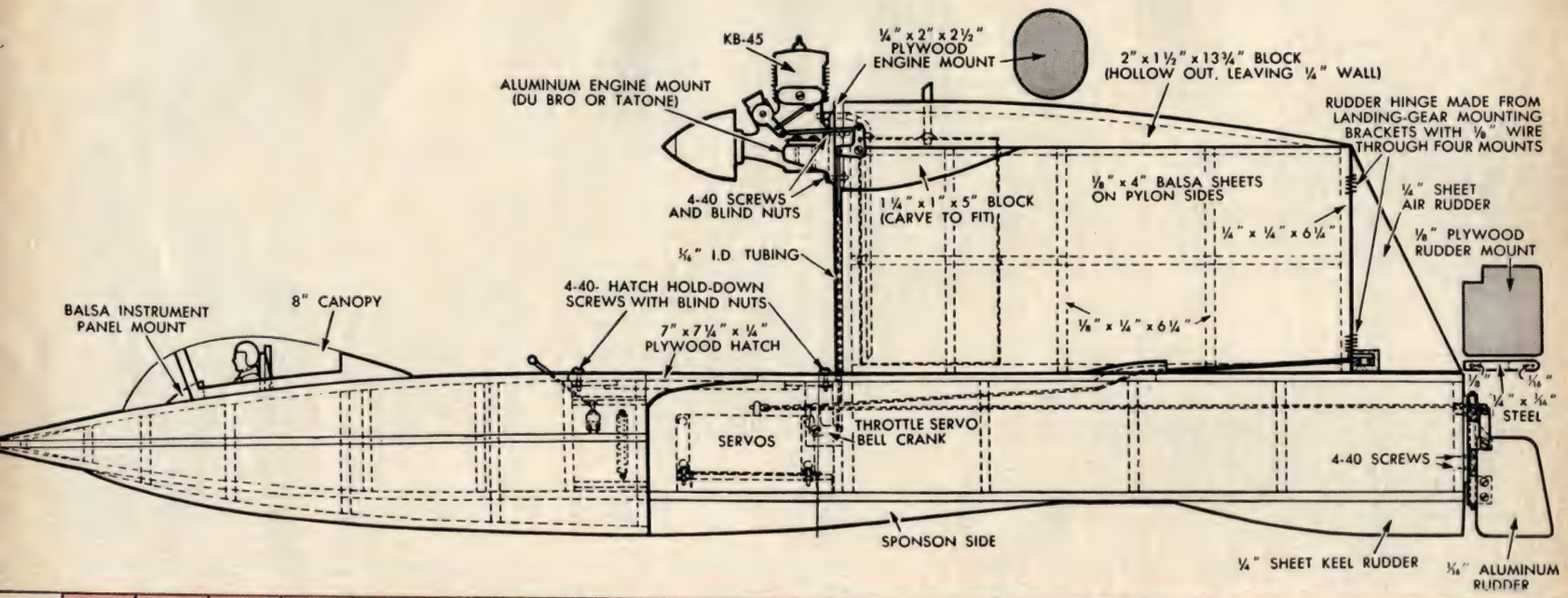
INSTALL ENGINE PYLON AND CONTROLS

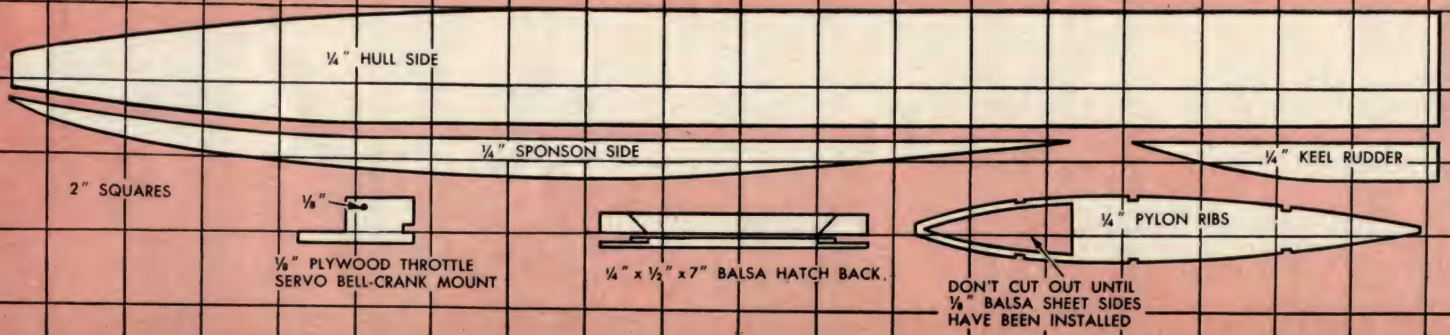
PLAN, PROFILE AND CUTTING DIAGRAMS

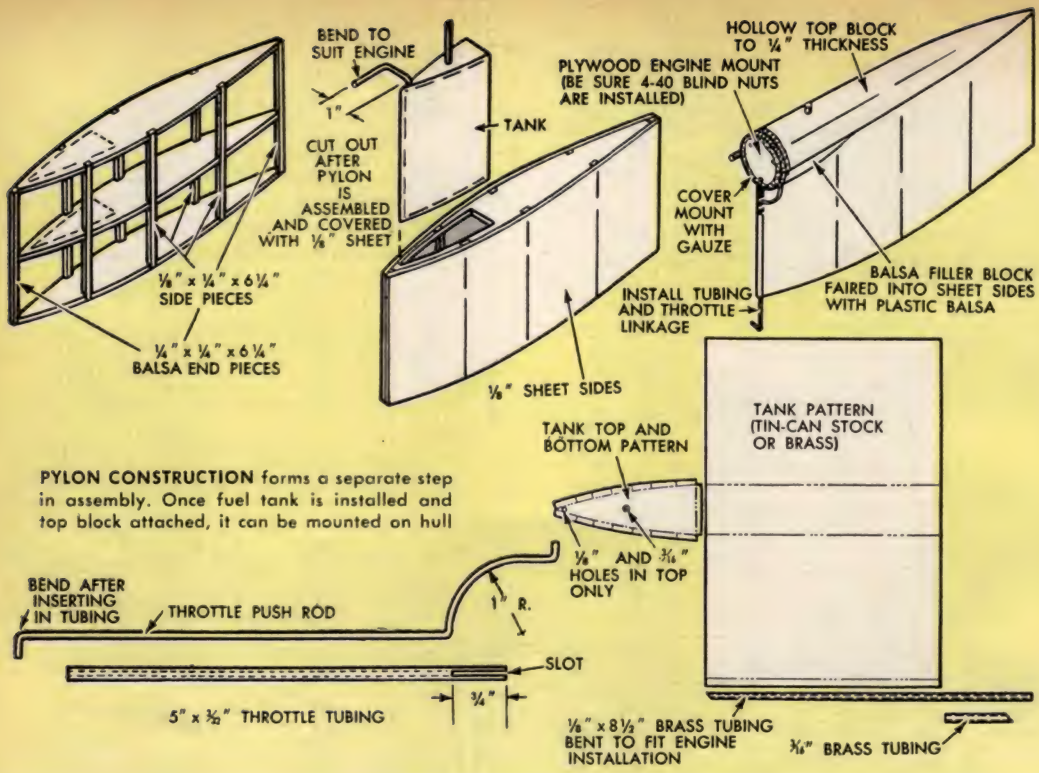




HALF-PLANS OF ALL FRAMES are included in the drawing at right. The heavy color line around the outside indicates the approximate configuration of the faired hull planking at frame H-8, rear of sponsons


KB-45
¼" x 2" x 2½" PLYWOOD ENGINE MOUNT
2" x 1½" x 13¾" BLOCK (HOLLOW OUT, LEAVING ¼" WALL)
ALUMINUM ENGINE MOUNT (DU BRO OR TATONE)
RUDDER HINGE MADE FROM LANDING-GEAR MOUNTING BRACKETS WITH 1/16" WIRE THROUGH FOUR MOUNTS
4-40 SCREWS AND BLIND NUTS
1 ¼" x 1" x 5" BLOCK (CARVE TO FIT)
⅛" x 4" BALSA SHEETS ON PYLON SIDES
¼" SHEET AIR RUDDER
¼" x ¼" x 6¼"
⅛" PLYWOOD RUDDER MOUNT
1/16" I.D TUBING
4-40- HATCH HOLD-DOWN SCREWS WITH BLIND NUTS
BALSA INSTRUMENT PANEL MOUNT
8" CANOPY
7" x 7¼" x ¼" PLYWOOD HATCH
⅛" x ¼" x 6¼"
⅛" x 1/16" x ¼" STEEL
SERVOS
THROTTLE SERVO BELL CRANK
4-40 SCREWS
SPONSON SIDE
¼" SHEET KEEL RUDDER
1/16" ALUMINUM RUDDER


¼" HULL SIDE
¼" SPONSON SIDE
¼" KEEL RUDDER
2" SQUARES
⅛"
⅛" PLYWOOD THROTTLE SERVO BELL-CRANK MOUNT
¼" x ½" x 7" BALSA HATCH BACK.
¼" PYLON RIBS
DON'T CUT OUT UNTIL ⅛" BALSA SHEET SIDES HAVE BEEN INSTALLED


BEND TO SUIT ENGINE
1"
TANK
CUT OUT AFTER PYLON IS ASSEMBLED AND COVERED WITH ⅛" SHEET
⅛" x ¼" x 6¼" SIDE PIECES
¼" x ¼" x 6¼" BALSA END PIECES
⅛" SHEET SIDES
PLYWOOD ENGINE MOUNT (BE SURE 4-40 BLIND NUTS ARE INSTALLED)
HOLLOW TOP BLOCK TO ¼" THICKNESS
COVER MOUNT WITH GAUZE
INSTALL TUBING AND THROTTLE LINKAGE
BALSA FILLER BLOCK FAIRED INTO SHEET SIDES WITH PLASTIC BALSA
TANK PATTERN (TIN-CAN STOCK OR BRASS)
TANK TOP AND BOTTOM PATTERN
⅛" AND 3/16" HOLES IN TOP ONLY
BEND AFTER INSERTING IN TUBING
THROTTLE PUSH ROD
1" R.
SLOT
¾"
5" x ½" THROTTLE TUBING
⅛" x 8½" BRASS TUBING BENT TO FIT ENGINE INSTALLATION
3/16" BRASS TUBING

PYLON CONSTRUCTION forms a separate step in assembly. Once fuel tank is installed and top block attached, it can be mounted on hull

After you have assembled *Miss Take*, remove the water rudder and hinge assembly, and give the boat at least three coats of clear butyrate dope. Then sand this smooth and cover the entire hull with silk or nylon. Follow this up with 10 coats of sealer.

Once the last coat has dried, wet-sand with fine sandpaper until all the wood grain disappears and you achieve a high gloss. Finally, spray with two coats of color and apply the trim. After hand-rubbing with rubbing compound, wash the boat with warm water to remove any remaining rubbing compound and spray four coats of clear dope to protect the color. A last rubbing, and the job is done.

Fasten the air rudder in position with heavy nylon thread, using a figure-eight stitch. Complete the boat by installing the engine mount, engine, servos and water-rudder assembly.

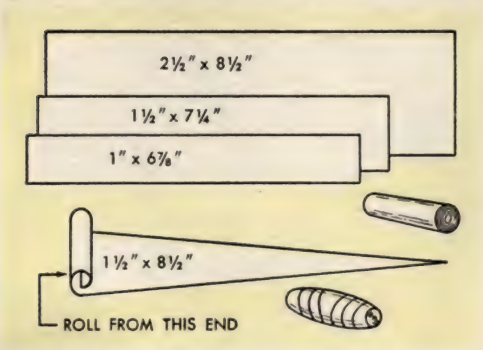
It's a good idea to seal the hatch with masking tape to keep water out of the radio compartment. Pack the receiver in foam rubber and protect it with a heavy plastic bag, sealing the end where the wires come out with a rubber band. Once, this is installed, pack foam rubber around all the radio gear to absorb any moisture.

It's impossible to keep all moisture out of the boat if you run it for a long period. Therefore, as soon as you take it out of the water, remove the hatch, receiver, power pack and all the foam. Let the foam and radio compartment dry overnight before running the boat again.

Do a careful building job, don't spare the finish and you'll turn out a beautiful boat that gives years of pleasure. ★★★

STREAKING ALONG the surface of small pond *Miss Take* leaves lower rooster tail than boat with water prop

Beaded Curtains Are Making a Comeback



In the 1890s, the height of fashion in home décor was the beaded curtain. Today's interior decorators have borrowed a page from the past in making these curtains popular once again. Though commercially manufactured ones are both costly and hard to find, you can make an attractive facsimile. The beads are merely paper strips rolled around a knitting needle. Rectangular strips roll into straight cylinders, while pennant-shaped strips form a bowed bead. Vary the sizes and colors. When each strip is rolled, glue the end down and seal all the edges by covering the entire bead with a thin coat of white shellac. The beads are strung on cord in random combinations with whatever loose glass and wooden beads you can rummage up from a jewelry chest or the baby's toy box. Install a curtain rod to take a 4-in.-wide strip of drapery material. Reinforce the bottom edge with stitching before sewing on each strand of beads to the drapery material.—*Pixie Faiman*

Novel Wall Plaques

A truly unique wall decoration can be made from a plastic bleach bottle. Use a sharp knife to cut the bottle in half lengthwise so that the flat side may be placed against the wall. Then paint the halves in whatever color you desire. The easiest way is to use a can of spray enamel but a careful job with a brush will also give satisfactory results. Some rickrack is cemented around at three levels. After gluing a few plastic flowers and a lace bow at the center, the half bottles are ready to be hung on your kitchen wall.

A rubber ring intended for use on a canning jar provides a coat-hanger bracket for your car. All you have to do to anchor the ring in position is crank up the rear window on it. The rubber will support several garments on hangers without scratching the window.

MODERN Rope Lore

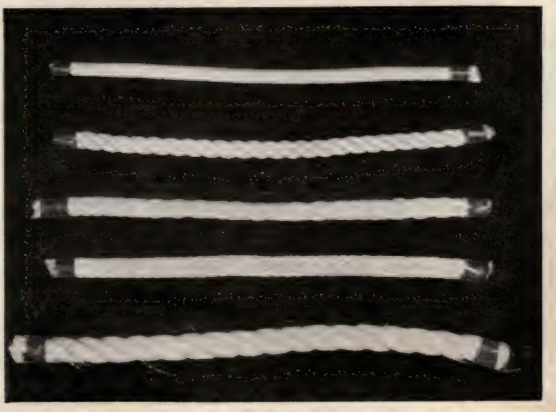
By Fred Clark

IN THE DAYS of the square rigger, a knowledge of marlinspike seamanship was essential for men who put to sea. Rope was so important to the safety and power of these wind-driven giants, that every sailor had to learn dozens of knots and splices. As a modern boater, you need only a smattering of this seagoing lore, but that smattering should be learned thoroughly.

Times have changed since the days of the clippers, and so have ropes. Though you still see a lot of manila around, the really savvy boater now uses synthetics instead of natural fibers. Unlike manila, man-made fibers don't rot, don't swell when wet and don't require drying before storage. With reasonable protection against chafing and overloading, synthetics will last five to six times as long as manila.

Four different synthetic fibers are available now, so manufacturers can tailor a line to the strength, stretch and abrasion resistance required for each boating problem. Let's consider some of the rope needs of the average boater.

DOCK AND ANCHOR LINES. Whether she swings to a mooring, lies in a marina berth, or is stored on a trailer, every boat needs adequate line for temporary docking and for anchoring off shore. In rough water or storm conditions, a boat will put a terrific surge strain on her lines, and as they pull her up short, they transmit a tremendous shock to the hull. You need strength to hold her and elasticity to cushion the shock. What is the best material for



this purpose and what size should you use?

A professional rigger would first ask, "What's the load?" No one has ever gone out in a storm and actually measured the strains which the average pleasure boat puts on her lines. However, for craft under 20 ft., ½-in. manila has done a fine job for years. Good ½-in. manila has a breaking strength of around 2600 lbs.

Another rule of thumb suggests that a boat's line should be able to lift her, and again the 2600-lb. figure is adequate for most small pleasure craft. Let's use the 2600-lb. test figure as a point of departure.

You can get this strength with ½-in. manila, ⅜-in. polyethylene, ⅜-in. polypropylene, ⅜-in. dacron or 5/16-in. nylon. Referring to the table below, you'll find that, with the exception of dacron, all of these cost about the same. Since nylon has the greatest elasticity, it is the odds-on choice. None of the others give the desired stretch. Most people who know the ropes make nylon their first choice for small-boat dock and anchor lines.

You'll want three or four dock lines, each about 1½ times as long as your boat —one for the bow, one for the stern and a spring line or two to keep her from moving fore and aft. (If you operate in an area with high locks or tidal range, you'll need longer lines.)

Good anchoring technique calls for putting out at least six times as much line as the depth of water. About 120 ft. is enough for most small boats. You won't need all this for fishing, or for burying the hook in the beach sand, but what about emergencies? That one time when you run out of gas rounding the point in a blow, you'll need a good hook and plenty of line if you are going to get home and tell the story. Check with your marine dealer for the preferred hook in your area, then carry enough line to let it catch.

SKIING. Ski ropes should be strong and reliable, with a minimum of stretch. Polyethylene, with its low stretch, is the top choice here. It has the additional advantage of floating. Polypropylene also floats, but its greater elasticity makes it a poor second to polyethylene. The stretch characteristics of nylon make it dangerous for ski line.

POLYETHYLENE SKI rope has two big advantages—it stretches very little and floats on the surface

WINCH LINES. Here, again, the line with a minimum of stretch is best, so polyethylene is a first choice, with polypropylene second. When buying winch line, pay close attention to the load. Dragging the boat up onto the trailer may build strains greater than the weight of the boat itself. Riggers tell us that a line should be worked at 20 percent of its breaking strain. If the proper size line isn't available or would crowd your winch, use wire. Since polyethylene knots tend to jam, splices are best for ski and winch line.

FOR SAILORS ONLY. The dock and anchor line requirements mentioned above hold just as well for windjammers as for those who use power. But when it comes to sheets and halyards, you have a different problem. Here, you not only want maximum stretch (so that the sails will stay where you trim them), but also a line

LINES TESTING APPROXIMATELY 2600 LBS.

SIZE	MATERIAL	BREAKING STRENGTH	WORKING LOAD	RELATIVE STRETCH AT WORKING LOAD	DOES IT FLOAT?	PRICE PER FT.
5/16"	DuPONT TYPE 707 NYLON	2850 LBS.	550 LBS.	FAIRLY HIGH	NO	.07 — .13
⅜"	DuPONT TYPE 67 DACRON	2850 LBS.	550 LBS.	LOW	NO	.14 — .27
⅜"	DIAMOND BRAID POLYETYLENE	2400 LBS.	475 LBS.	VERY LOW	YES	.08 — .11
⅜"	POLYPROPYLENE	2550 LBS.	512 LBS.	LOW	YES	.075 — .115
½"	YACHT MANILA	2650 LBS.	530 LBS.	LOW	NO	.075 — .095

ALL FIGURES APPROXIMATE. PRICE VARIATIONS WERE ARRIVED AT BY CHECKING DIFFERENT SOURCES, WITH LOWEST PRICES GENERALLY QUOTED BY DIRECT MAIL HOUSES.

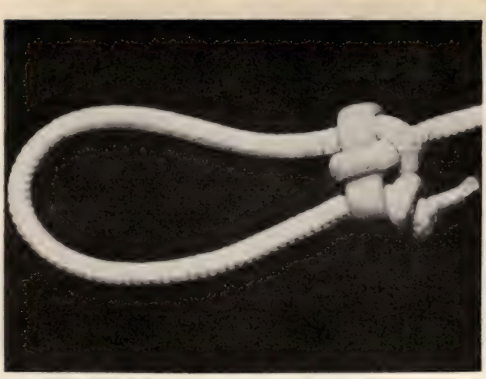
SPLICING BRAIDED ROPE

AFTER STOPPERING strands by taping about 6 in. from the end, heat each strand in turn with a match

WHEN STRAND FIRES UP, wipe it with a wet rag, twisting in the direction of lay, to make chisel point

WORKING INSTRUCTIONS for weaving splice are supplied by manufacturer. Follow them and avoid trouble

FINISH EYE SPLICE by whipping each strand, then whipping spliced section and sewing through splice



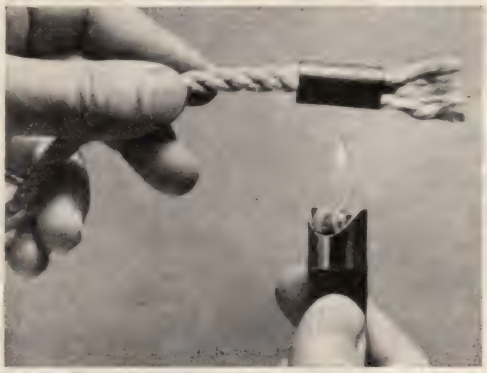
RAZZLE-HITCH, a short-cut rope fitting made of heavy-duty nylon, may often be used in place of knot

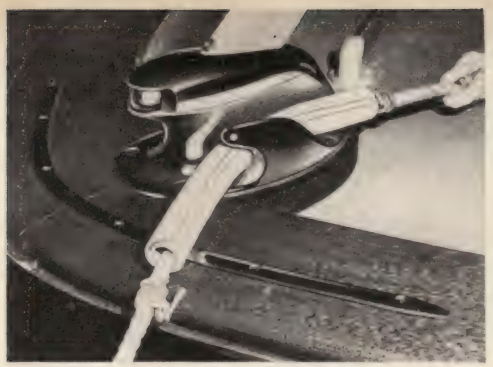
that handles easily and works well.

Polyethylene is slippery and tends to kink, tangle and jam knots, so it's not a good choice. This is where the advantages of dacron come to the fore. Nylon's elasticity makes it unsuitable, and polypropylene is still generally untested for sheets and halyards.

Dacron, and nylon are available in twisted, laid construction, as well as in braided cover with braided core. Compared with twisted rope of the same material, braid has a little extra strength, a little

PLASTIC WHIPPING (actually heat-shrinkable tubing) comes in three diameters, it shrinks in 10 seconds





CHAFE GUARDS available commercially are simply split rubber tubes. Plastic hose also does a good job

less stretch and a little more resistance to abrasion. They are so nearly equal, however, that most people base their decision on which type feels best to them. Some sailors use twisted line for halyards, where there is limited scuffing, and braid for their main and jib sheets, which are constantly rubbing through blocks, winches and jam cleats. This choice works well.

TOWING. If you tow a dinghy behind your family boat, polypropylene is the best bet. Its ability to float will help keep it out of the propeller, and its stretch will ease the surge load on both the tow boat and little fellow. Nylon equipped with floats would be the second choice here.

And speaking of towing, suppose you run across a boat with engine trouble or out of gas. With its length, strength and elasticity, you'd heave him your anchor line, naturally. But watch that nylon!

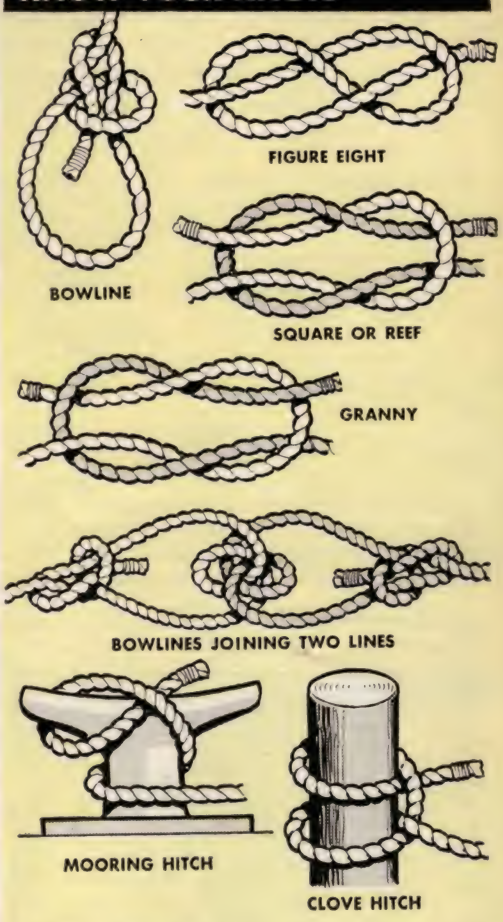
When towing, particularly in rough weather, you may strain a line past its breaking point. When nylon breaks it stretches some 30 to 40 percent beyond its normal length and lets go with a sound like a pistol shot. The backlash is enough to injure anyone in its way, so keep your crew away from a straining nylon tow rope.

CLEATS AND CHOCKS. Just as a line should be able to lift the boat, so also should the cleats be equal to the strain. Better do a little rug lifting, and see what's underneath all that polish and chrome.

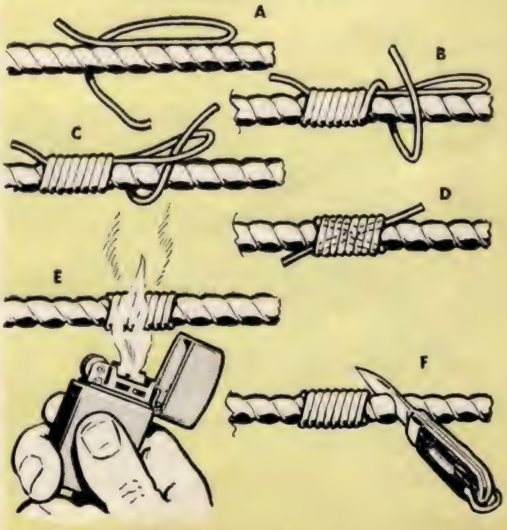
The strongest type of cleat is the lifting ring which goes right through the deck and fastens to the keel. You can get the same security by attaching a stout eye to the keel, and one to the underside of the cleat. Connect the two with chain and a turnbuckle.

Chocks lead the lines where you want them to go, and also reduce abrasion by giving the line a smooth rubbing surface. If yours are deficient, replace them with overlapping "skene" chocks which help

KNOW YOUR KNOTS



TO WHIP ROPE with nylon whipping thread, wind thread over loop and pass end through loop, then pull loop under whipping, clip loose ends and heat whipped section to melt wax coating and fuse strands



MATCHING THE ROPE TO THE JOB

PURPOSE	REQUIREMENTS	NYLON	DACRON	POLYETHYLENE	POLYPROPYLENE
DOCK & ANCHOR	ELASTICITY	TOPS	FAIR	NOT RECOMMENDED	FAIR
SKI & WINCH	MINIMUM STRETCH	NOT RECOMMENDED	FAIR	TOPS	FAIR
HALYARDS & SHEETS	MINIMUM STRETCH, EASY WORKING	NOT RECOMMENDED	TOPS	NOT RECOMMENDED, TOO SLIPPERY	FAIR
DINGHY TOWLINE	ELASTICITY & BUOYANCY	GOOD IF FLOATS ARE ADDED	FAIR	FAIR	TOPS

keep the line in place when it gets an upward pull.

But chocks or no, chafe is the cannibal of the rope world. Despite claims of abrasion resistance, no rope is safe against prolonged rubbing in the same area. Whenever such a problem might develop, protect the rope with chafing gear. Old timers used canvas, but a length of plastic hose will do the same job. The commercially available split rubber guards are so inexpensive and handy to use that you'll probably want to try one before adopting cheaper but less convenient methods.

KNOTS. As far as knots and splices go, there are a few tricks peculiar to synthetics. Almost without exception, the man-made fibers are more slippery than natural fibers. Since knots depend on friction between rope surfaces for their holding power, you'll have to go an extra step to be sure they won't slip loose.

The one knot that all sailors need to know is the bowline (rhymes with stolen). It's useful for mooring, anchoring, joining two lengths of synthetic, hoisting sails and in countless other situations. The trick with this knot is that you pull on the standing part of the line to tighten it and push on the standing part to loosen.

Another handy knot, frequently used for temporary mooring to a post or ring, is the round turn and clove hitch. The straight clove hitch tends to slip, unless there is tension on both ends. Take a turn round the post and then make a clove

(Please turn to page 194)

ALTERNATE TO WHIPPING is covering end of rope with plastic cap. First, tape strands with marine tape

SLIP PLASTIC CAP over end of line, wipe off any excess glue and allow sufficient time for drying

APPLY LIBERAL COATING of waterproof glue to the taped end as far back as the plastic cap will cover

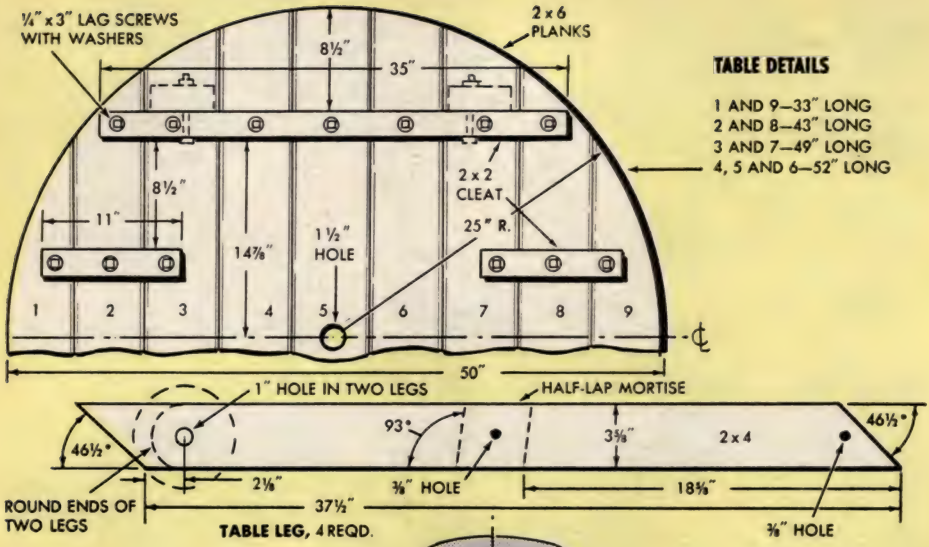
LAZY-SUSAN PATIO TABLE

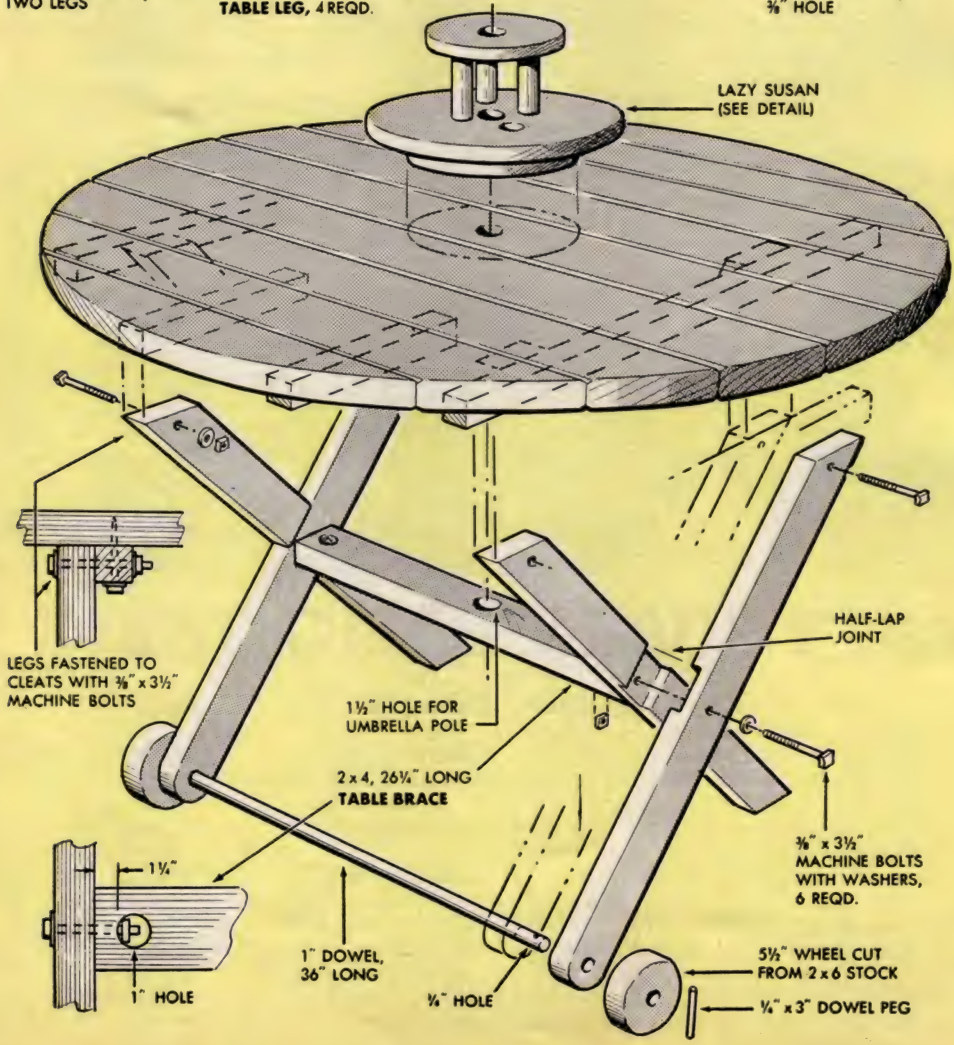
By Steve Ellingson

KING ARTHUR started it all. We are told he used a round table to prevent jealousy over seating precedence but I suspect that he had a more practical reason —the simple fact that more people can be seated at a round table than at a square one of like size.

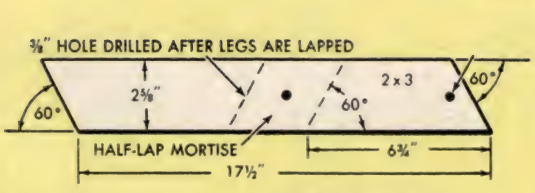
The round dining set pictured above seats eight, two per bench, and features a handy Lazy Suzan in the center. While the set was designed primarily for patio and backyard use, it may be given a fine finish and used indoors. Indoor furniture of this type has recently gained popularity with decorators—especially for colonial game rooms and big, farm-style kitchens.

Redwood is the most appropriate and durable wood to use. In making the table, note that the half-lap leg notches are cut slightly off square—93 deg. The 50-in. circular top is scribed on nine 2 x 6 boards of varying lengths to minimize waste. Mark a centerline across each board, then lay all flat, side by side, and align the

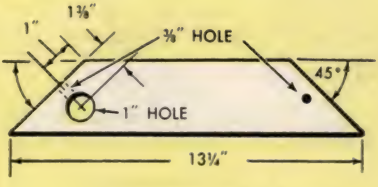

¼" x 3" LAG SCREWS WITH WASHERS
2 x 6 PLANKS
8½"
35"
TABLE DETAILS
1 AND 9—33" LONG
2 AND 8—43" LONG
3 AND 7—49" LONG
4, 5 AND 6—52" LONG
2 x 2 CLEAT
8½"
11"
14⅞"
1½" HOLE
25" R.
1 2 3 4 5 6 7 8 9
50"
1" HOLE IN TWO LEGS
HALF-LAP MORTISE
93°
3⅜"
2 x 4
46½°
46½°
2⅛"
⅜" HOLE
18⅝"
ROUND ENDS OF TWO LEGS
37½"
TABLE LEG, 4 REQD.
⅜" HOLE


LAZY SUSAN (SEE DETAIL)
LEGS FASTENED TO CLEATS WITH ⅜" x 3½" MACHINE BOLTS
HALF-LAP JOINT
1½" HOLE FOR UMBRELLA POLE
2 x 4, 26¼" LONG TABLE BRACE
⅜" x 3½" MACHINE BOLTS WITH WASHERS, 6 REQD.
1¼"
1" HOLE
1" DOWEL, 36" LONG
¼" HOLE
5½" WHEEL CUT FROM 2 x 6 STOCK
¼" x 3" DOWEL PEG

BENCH DETAILS



BENCH LEG—16 REQD.



BENCH LEG BRACE, 8 REQD.

MATERIAL LIST

REDWOOD

4 pcs.—2 x 6 x 10 ft.	Bench tops
5 pcs.—2 x 6 x 8′	Table top
1 pc. —2 x 4 x 8′	Table legs, cross brace
1 pc. —2 x 4 x 10′	Table legs, cross brace
1 pc. —2 x 2 x 8′	Bench cleats
1 pc. —2 x 2 x 6′	Bench cleats
4 pcs.—2 x 3 x 10′	Bench legs, braces
1 pc. —¾ x 16 x 30″	Lazy Susan

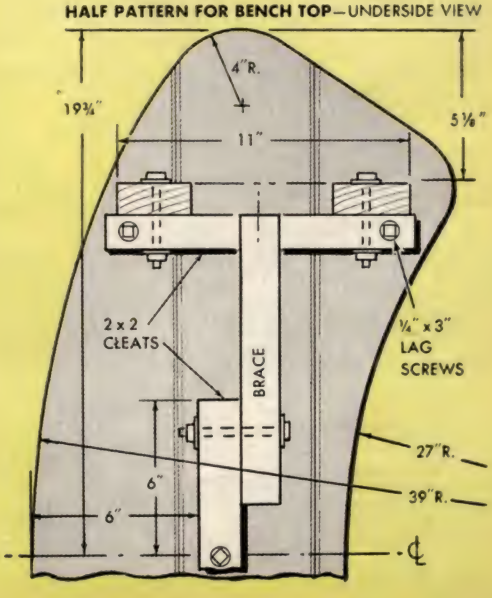
HARDWARE

38—⅜″ x 3½″ Machine bolts, nuts, washers
54—¼″ x 3″ Lag screws and washers
1—6″ Lazy-Susan bearing

MISC.

1—1″ x 36″ hardwood dowel
Wheel axle
1—¼″ x 6″ hardwood dowel
Wheel cross pins
1—1″ x 36″ hardwood dowel
Lazy-Susan posts

HALF PATTERN FOR BENCH TOP—UNDERSIDE VIEW



TWO WAYS you can decorate the top of the Lazy Susan. Disks in photo at right are sliced from 1-in. dowel

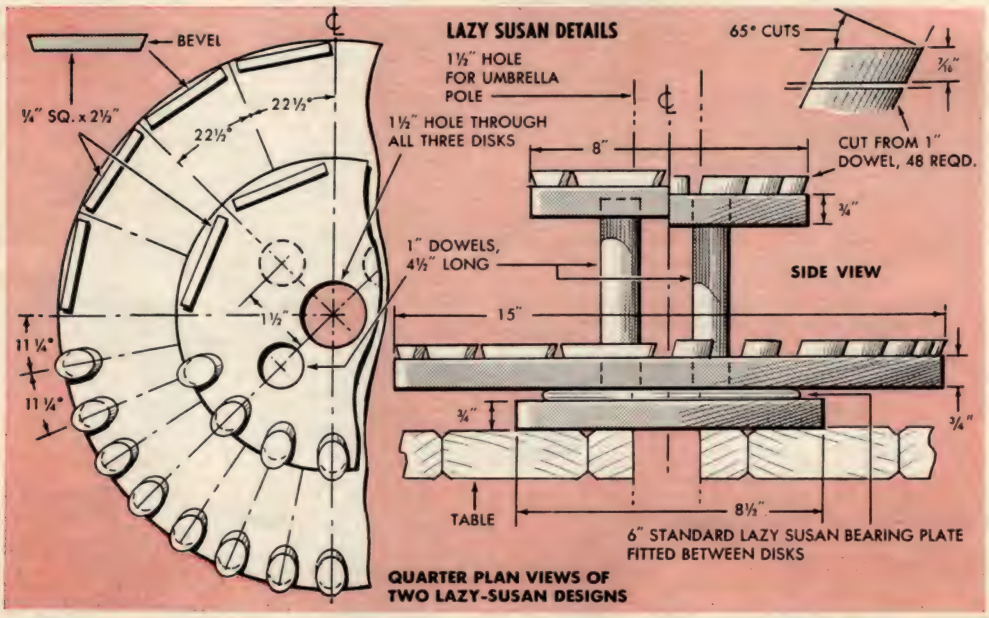
marks. Swing the circle, using a yardstick or similar strip as a compass, and saw each board individually before lagscrewing 2 x 2 cleats to the underside. If you plan to use an umbrella, bore a hole through the center board large enough for the pole to slide in and out easily.

The underframing of the table goes together like a saw buck, machine bolts being used to draw the legs up rigidly to the center brace and to the 2 x 2 cleats. The rest is simple enough.

The kidney-shaped top of each bench is made up of three 2 x 6 redwood boards placed side by side and marked for cutting by swinging the radii given. Saw the boards individually as before, then lagscrew 2 x 2 cleats to the underside. The saw-buck legs are bolted to the cleats, as with the table, then rigidly braced with angle-cut braces.

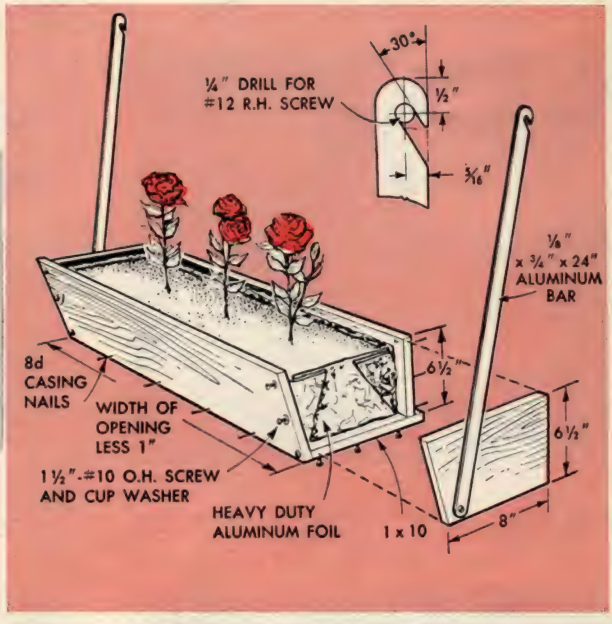
You have a choice of making the Lazy Susan two ways. Basically it's the same in each case, differing mainly in the treatment of the decorative edging. The umbrella hole passes down through a hole in the center, and a Lazy-Susan bearing is used to make it turn easily. ★★★

While you shouldn't have any trouble building this outdoor dining set from the details presented here, you may prefer to work from a large drawing. If so, a full-size plan can be obtained by sending $1.00 to Steve Ellingson, Popular Mechanics Pattern Dept., Box 2383, Van Nuys, Calif., and asking for pattern No. 239-L.



Hanging Window Box Serves Year Round

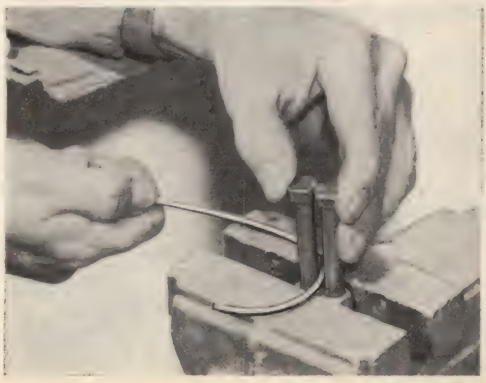
YOU CAN MAKE use of a window box the year round if you merely suspend it from aluminum brackets like these, which hook over sturdy round headed screws driven into the window frame, both inside and out. When the growing season is over outdoors and the box is emptied, it can be hung inside and used to hold potted plants. In either case, the box simply rests on the window sill. While it's hung from the outside frame, it prevents the use of a conventional window screen, but ventilation can be provided if necessary by using a sliding screen insert which still permits tending the plants from indoors. Lining the box with aluminum foil will protect the wood when filled with dirt, but you should provide drainage by poking holes in the foil over the drain holes in the bottom of the box.—*Dave Swartwout*



Wire Bending Jig

Want to do a neat job of wire bending? Smooth bends are a cinch if you thread nuts on to a couple of bolts and then grip the nuts in your bench vise. Bend the wire around the shank of the bolt as shown to form a partial curve or even a complete loop. You'll find that this is an easy way to make tool hangers for your shop.

A rubber floor mat on your bench top will not only protect it from damage but also catch small parts, screws, etc., which might otherwise roll off on the floor and become lost.

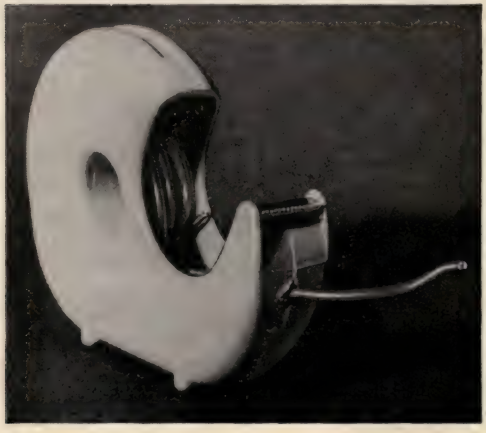


Solving HOME PROBLEMS

WANT A RACK to hold tubes of glue, wood filler, etc.? Cut the boxes at a 45-deg. angle and tack to a piece of scrap lumber mounted near your bench

WHEN THAT PACKAGE arrives from the mail-order house, you often end up with excelsior scattered on the rug. A damp sponge will pick it up in no time

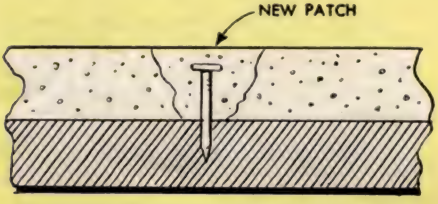
NEAT SOLDER DISPENSER was a cellophane tape dispenser. Make a small hole in the front of the holder, wind solder around spool and run it out hole

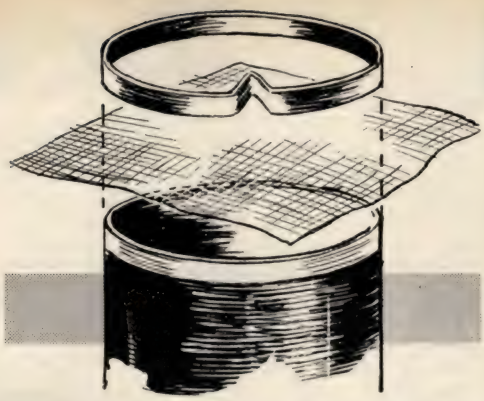


HULLING A COCONUT is easy if you have a pick handy. Sink blade into ground and set your foot on handle to hold it, then jab coconut down on sharp point. A twist of the wrist and it's open

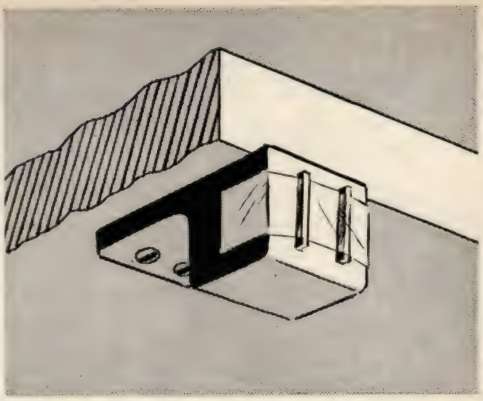
RUBBERBAND twisted around the end of thermometer keeps that expensive glass tube from flying out of your hand when shaking mercury down. It's low-cost insurance against breakage

PATCHING PLASTER can be anchored more securely in cracks and larger areas if you first drive nails in the lath until the heads are slightly below the surface. Space the nails 1 to 2 in.





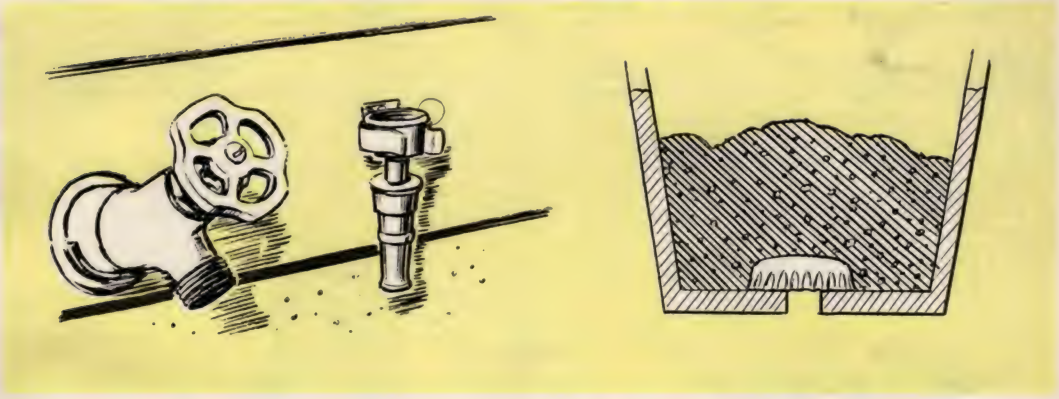
PERFECT STRAINER for paint can be made by prying off rim of a coffee can and crimping as shown, then using this to stretch cheesecloth over can. Just press the rim and cheesecloth into the top of the can



YOU CAN ADJUST the amount of force required to open a door with a magnetic catch by covering the magnet with a strip of cellophane tape. If it's still too strong, add more tape, one strip at a time

TO KEEP TRACK of the nozzle after attaching the hose to a lawn sprinkler, place it in a broom clamp screwed near the sill cock. Stored in this manner you'll know right where it is to put back on the hose

DRAIN VALVE for potted plants is just a beverage bottle cap. Crimped edges of the cap allow excess water to drain out, but tend to prevent root growth or loss of soil through the drain hole in the pot



A WOODEN KITCHEN SPOON will do a far better job of scraping food from the bottom of a sauce pan if you square off the rounded end. After sawing off about a third of the bowl, bevel edge and sand

PLANT PROTECTOR can be made from plastic bleach jug by cutting off the top and bottom, then placing this over the plant, hilling dirt around it and securing a plastic bag over it with a rubber band

DON'T LET A FIRE CATCH

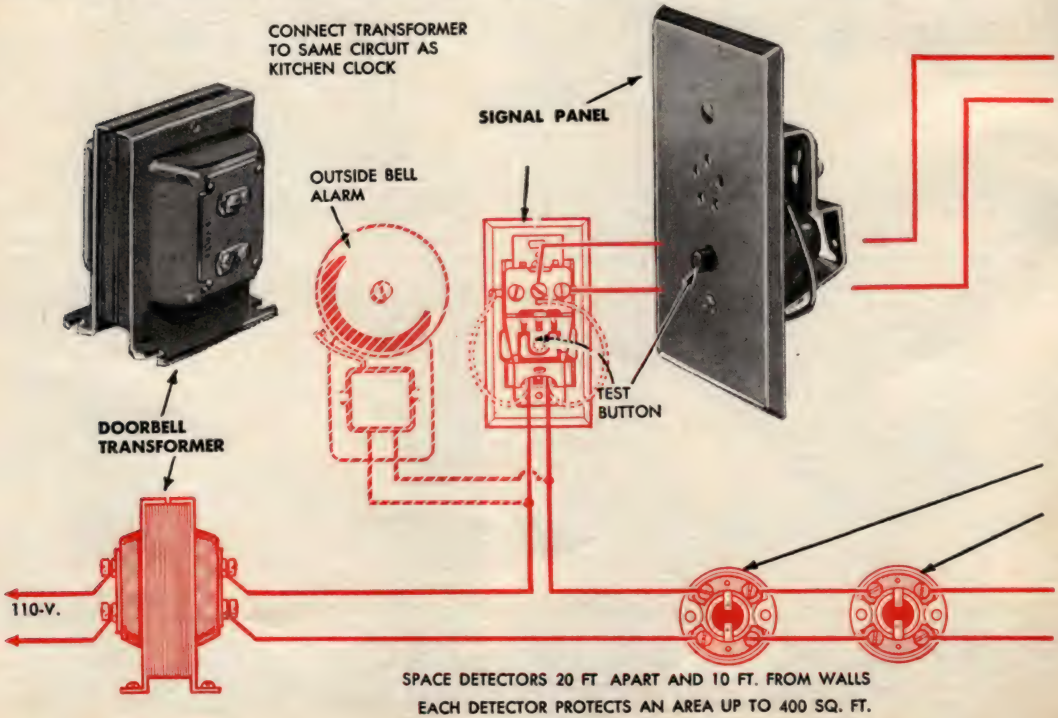
NO MINUTES are more precious than the first five after a fire breaks out. How they're used can mean the difference between life and death for you and your family. We all know that the large majority of serious home fires flare up when everybody's asleep. But many homeowners assure themselves that they'd be awakened by the sound and smell in plenty of time to get their family to safety. The facts don't support this: You might be able to outrun the *flames*, but most fire deaths aren't from burns—they're from suffocation, often while the victim's asleep.

This is especially true when upstairs bedrooms are involved; heat *rises*, and its intensity—or the toxic fumes swept up with it—can kill you in your sleep while the fire itself is still downstairs. Over ¾ of our annual home-fire victims could have been saved if they'd been awake in time to climb out an upstairs window while the fire was confined to the first floor.

It's a grim irony that we equip empty office buildings with night alarm systems, yet neglect such protection for homes full of sleeping people! Perhaps most homeowners find the cost of a commercial system prohibitive. If so, the simple homemade circuit diagrammed below solves the problem. You don't even have to buy a new transformer, if you have the usual doorbell setup. Your only expense will be the signal panel and the detectors (as many as you need—at about $1.25 each—to guard the areas where fire is likely: furnace room, attic or storage closets).

The units pictured below are made by Edwards Co., Norwalk, Conn. and are sold separately by electrical supply stores. The signal panel is nothing more than a button-and-bell combination, designed to fit into a standard switch box. To adapt it to an alarm system, you need only separate the leads from the soldered connections (indicated by dotted lines) and put them to work in the circuit. Locate the panel in or near the master bedroom.

The UL-approved detectors are inconspicuously mounted on the ceilings of the chosen areas; there's no limit on the number you can wire into one circuit. Should any sort of combustion occur, heat rising to the ceiling will trigger one of the units as soon as the temperature reaches the level at which the unit is designed to react. This closes the circuit and sounds the bell tucked behind the panel. The alarm continues until the heat diminishes enough to let any triggered detector in the

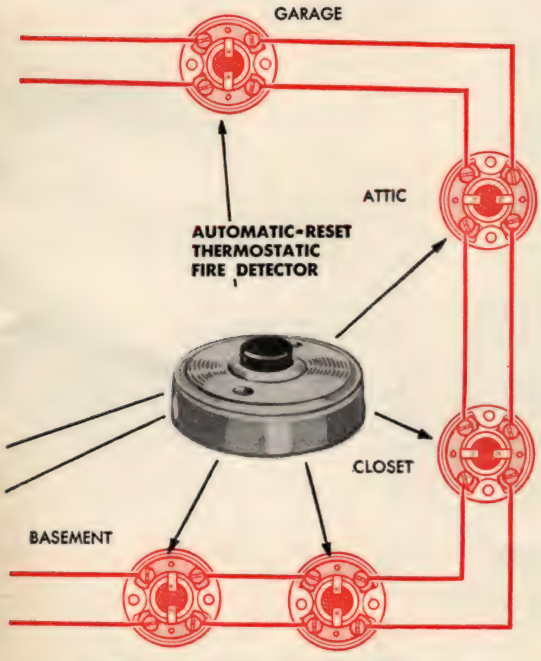

CONNECT TRANSFORMER TO SAME CIRCUIT AS KITCHEN CLOCK
SIGNAL PANEL
OUTSIDE BELL ALARM
TEST BUTTON
DOORBELL TRANSFORMER
110-V.
SPACE DETECTORS 20 FT APART AND 10 FT. FROM WALLS
EACH DETECTOR PROTECTS AN AREA UP TO 400 SQ. FT.

YOU ASLEEP

circuit reset itself automatically. For most installations, 135-degree units are best, but you might want to use the 190-degree type in areas subject to high normal temperature, such as near the furnace. An optional 8-in. weatherproof bell can be installed outside, under the eaves, to alert neighbors or passers-by when you're away from home.

Many commercial systems require their own battery power, and the makers of such equipment like to point out that plug-in systems are of no value when a power line's down or a fuse is blown. We might counter that a battery-operated alarm is of little use if you forget to keep fresh batteries in it. Either way, it's important to be sure the system is functioning. That's why the one below is provided with a test button you can press at any time. As an added check, hook the transformer into the same circuit as an electric clock. A stopped clock is usually one's first clue of a power failure. If you want to run an occasional *heat* test of individual detectors, merely hold a lighted match under the thermostatic element. The alarm won't continue long enough to be a nuisance, once you blow out the match.

(Please turn to page 190)



USE REGULAR #18 PARALLEL OR TWISTED WIRE

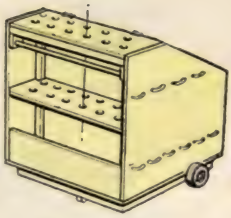
Rolling Garden Workshop

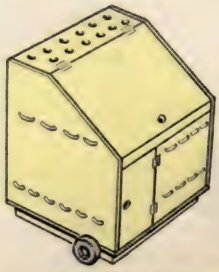
TIRED OF MAKING trips back and forth to the garage for a forgotten garden tool? The smart gardener (gal or guy) keeps his "down-to-earth" tools in a handy caddy like this. Bristling with some 25 garden implements ready for use, it pushes around like a peddler's cart and leaves you wanting for nothing in rooting to your hearts content. When through, you just roll it into garage or carport and park it.

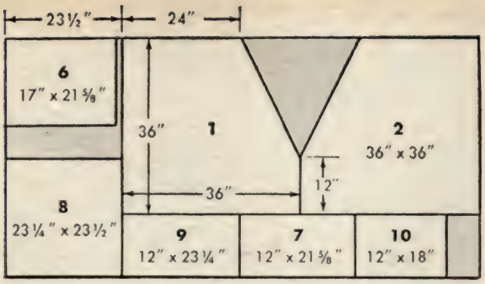
Designed in cooperation with True Temper Corp., our compartmented cart has a place for everything. There's a dry bin with a lid which holds up to three bags of fertilizer, peat moss, etc. There's convenient storage for a goodly number of pots, and a potting bench to boot. You can put a dozen long-handled tools aboard in a rack at the rear, and slip any number of short-handle tools in elastic loops along both front and sides.

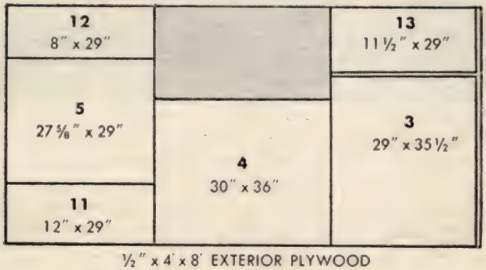
With the exception of a few pieces of solid wood, the whole thing can be cut from two sheets of 4 x 8-ft. outdoor plywood, ½ in. thick. The cutting diagrams show how the 13 parts are laid out on your two plywood sheets. The dowel push-handle is installed between the sides about 6 in. down from the top. A large swivel caster makes it roll along easily.

You'll see this colorful garden-tool taxi parked in the garage of the *House of Good Taste* when you visit the 1964-65 New York World's Fair. Located just inside the main Fair gate, this display home is one of several designed by outstanding architects. Make it a point to look for *PM*'s garden workshop on wheels.

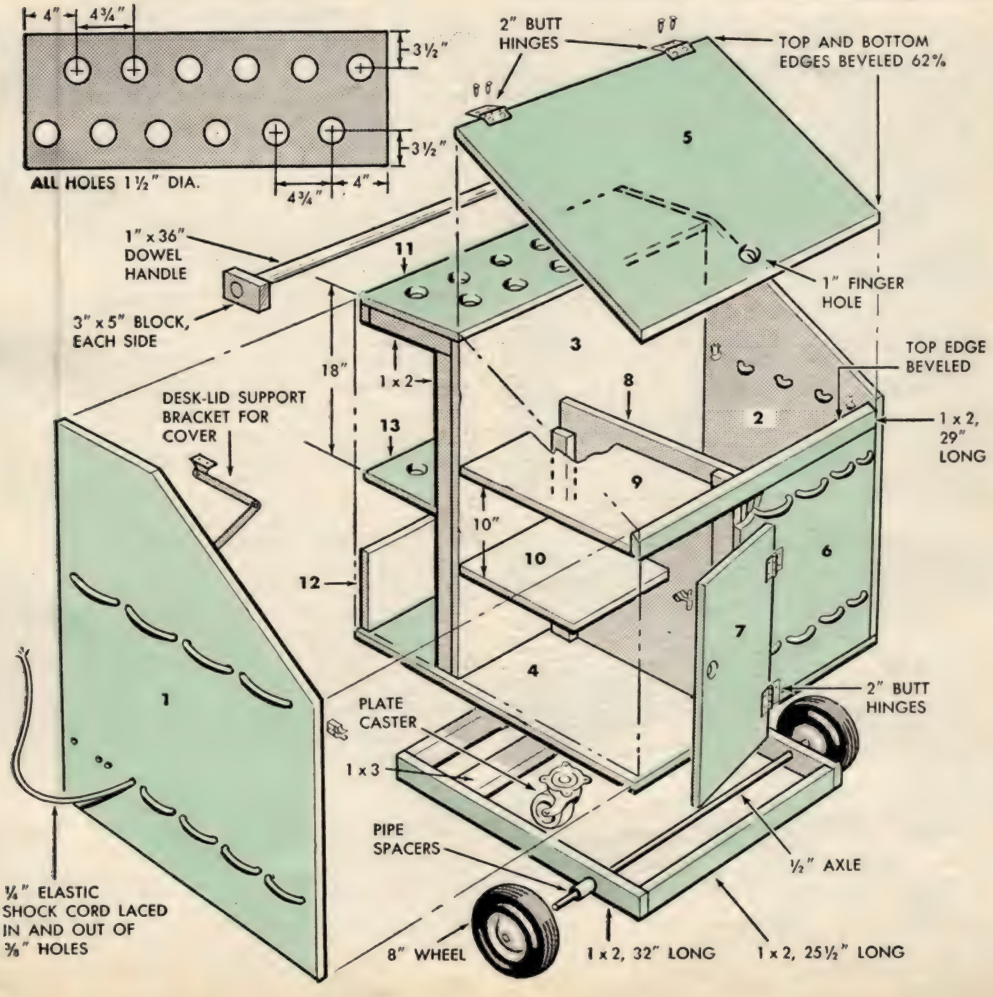




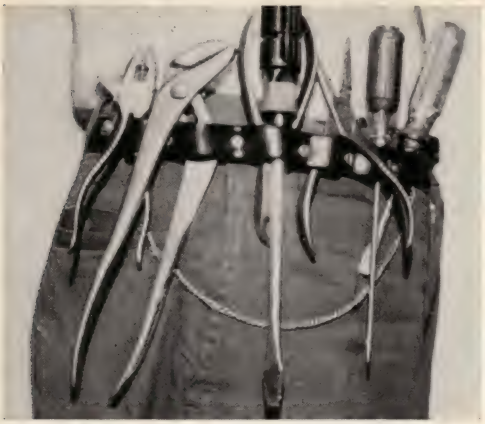


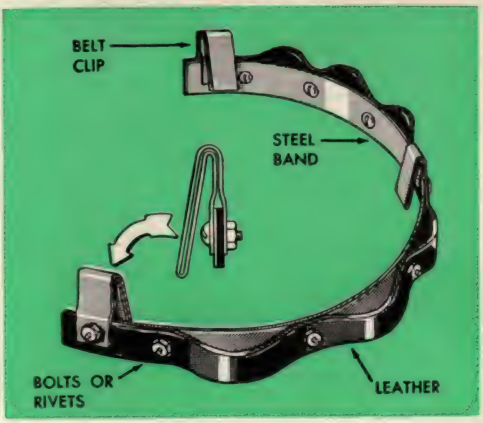


½" x 4' x 8' EXTERIOR PLYWOOD



Electrician's Tool Belt Permits Quick Draw





This belt's unusual design permits the wearer to carry an assortment of small tools ready for instant use. There's a separate loop for each tool and unlike the conventional tool holster, the weight is distributed around nearly half the waistline, so there is no discomfort. The holder is made from a strip of aluminum and a leather strap or discarded belt riveted or bolted to it to form loops. Three clips, made from spring steel, hook the holder to the trouser belt.—*Felice Lister*

Dividers Cut Disks

Next time you run out of sanding disks try cutting your own. Set a pair of dividers to the proper radius, using the sander pad as a guide. Then lay a sheet of sandpaper face down on a piece of cardboard. Hold the divider points firmly against the sandpaper and rotate several times until the paper is heavily scored. The disk can then be easily pressed from the sheet.

There's no need to grease your car's speedometer cable every six months if you rub the cable with petroleum jelly and then squirt powered graphite over it. Work this mixture into the cable thoroughly for a long lasting lubrication job.

Belt Down That Deck

Here's a neat trick to keep in mind when you're faced with the job of hauling a large crate, bicycle or other bulky load in your car trunk. Snub down the rear deck with an old stretch belt passed through the openings in the latch mechanism. The belt's elasticity will prevent the deck from bouncing as you ride. Keep an old belt in the car trunk for just such a purpose.

Do you have a balky ball point? Centrifugal force may help to make it write again. Tie a 2-ft. length of string around the clip and whirl the pen for about a minute to force the ink down to the point.

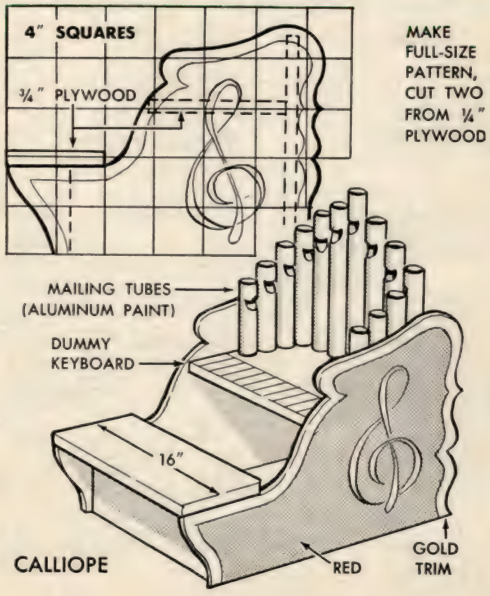
4TH OF JULY FUN: 8 FLOATS FOR YOUR OWN CIRCUS PARADE

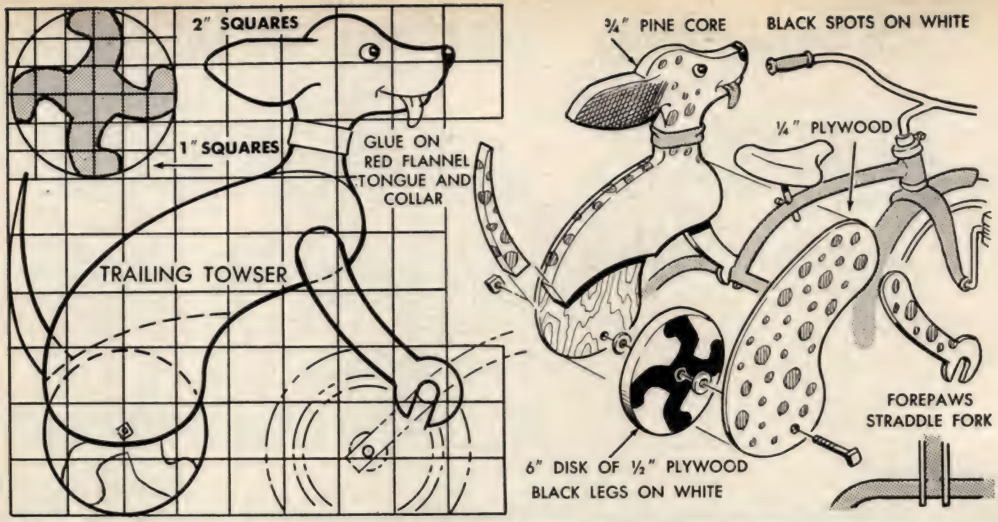
By Hi Sibley

SAFE, SANE . . . and dull—that's what the Glorious Fourth has become in many towns, ever since we literally took the *bang* out of the kids' fun. They won't miss the firecrackers, though, if you help them organize their own neighborhood parade. You might even offer a prize for the best-made "float."

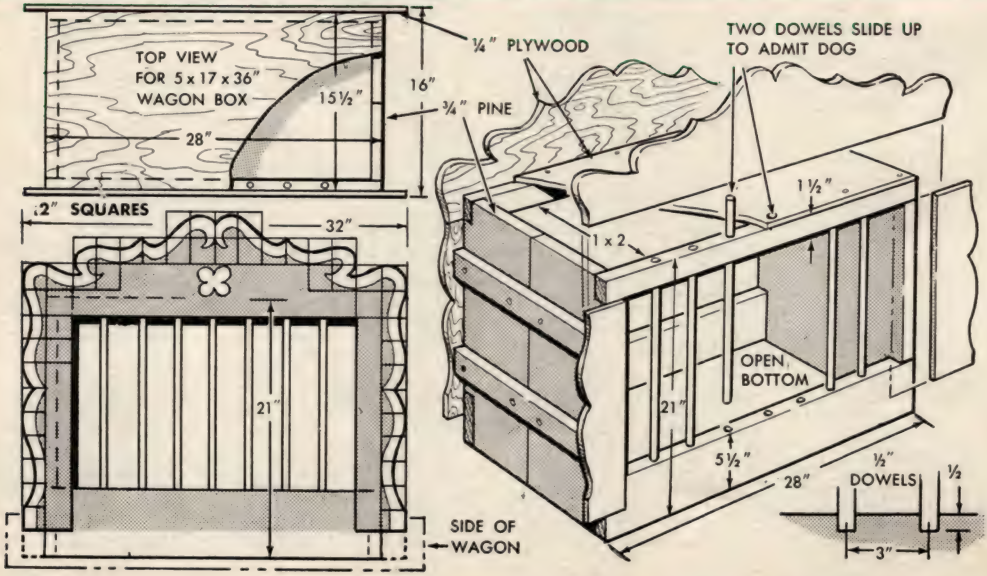
Taking the general theme of a Circus March, we've dreamed up a parade that makes good use of the possessions youngsters like to show off most: animals and vehicles. Some of the ideas detailed on the following pages are ideal for a pet parade. Two of the others would win cheers in any bike dress-up contest. Add a few clever wagon and trike costumes and you'll have a full-dress street spectacle!

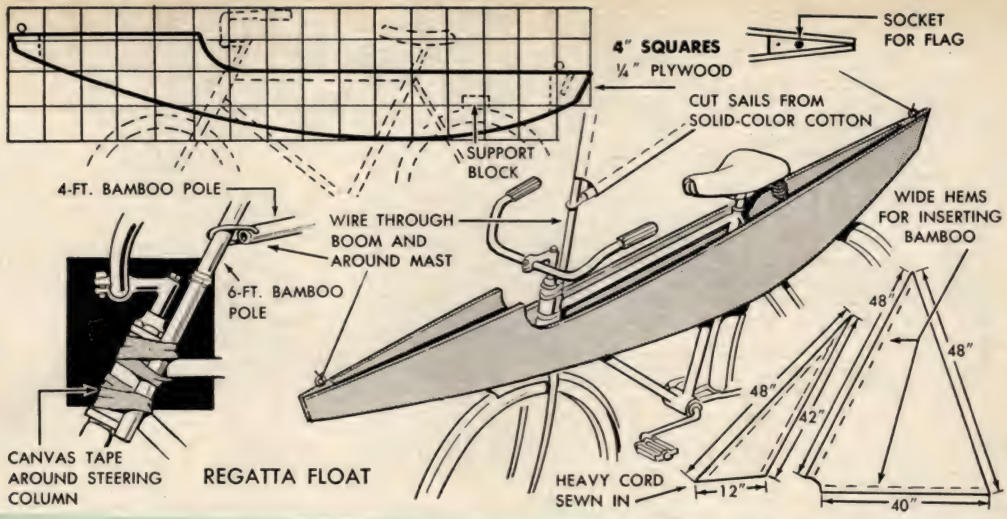
These designs are as kind to the vehicles as they are to the pets. Since they're intended as temporary costumes, there's nothing to mar the bike or wagon when they're removed. Where necessary, materials are bound to the frames with tape.




2" SQUARES
1" SQUARES
GLUE ON RED FLANNEL TONGUE AND COLLAR
TRAILING TOWSER
¾" PINE CORE
BLACK SPOTS ON WHITE
¼" PLYWOOD
FOREPAWS STRADDLE FORK
6" DISK OF ½" PLYWOOD BLACK LEGS ON WHITE

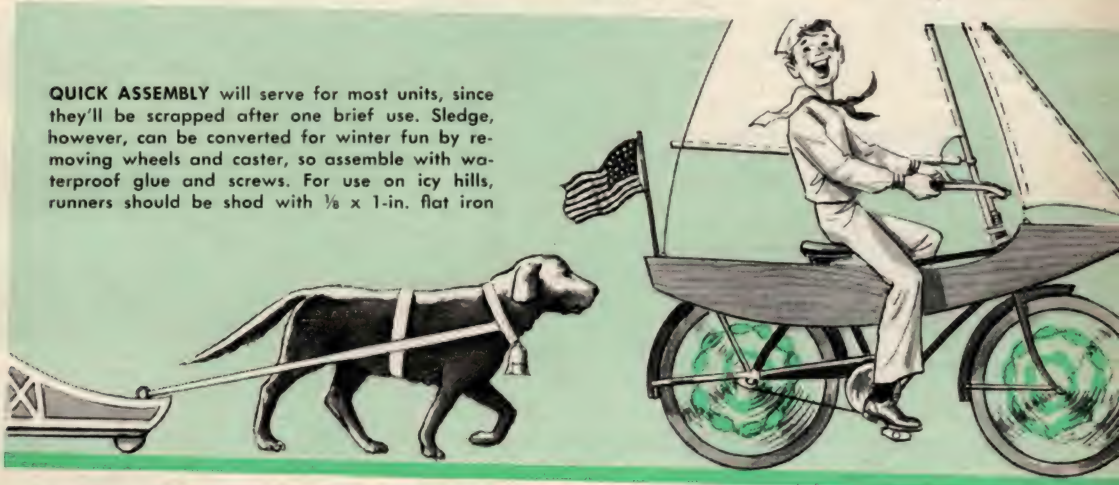
GRIZZLY BEAR
MUSH!

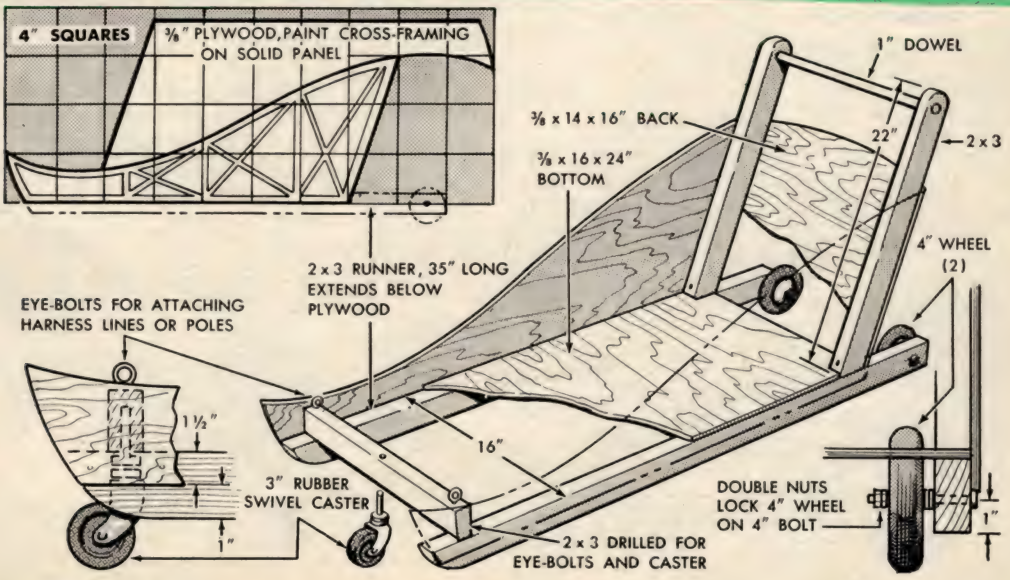

TOP VIEW FOR 5 x 17 x 36" WAGON BOX
15½"
28"
16"
¼" PLYWOOD
¾" PINE
TWO DOWELS SLIDE UP TO ADMIT DOG
2" SQUARES
32"
21"
SIDE OF WAGON
1 x 2
1½"
OPEN BOTTOM
21"
5½"
28"
½" DOWELS
½
3"

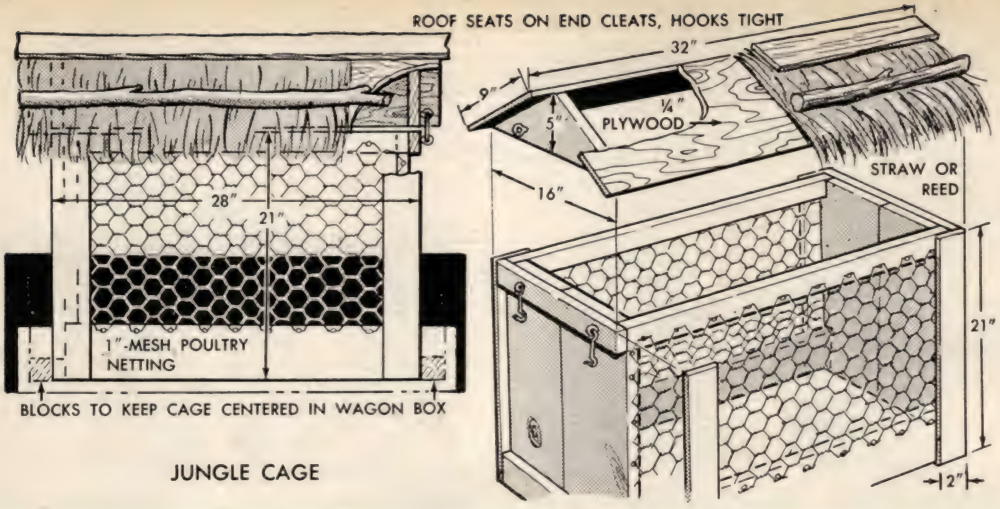


REGATTA FLOAT

QUICK ASSEMBLY will serve for most units, since they'll be scrapped after one brief use. Sledge, however, can be converted for winter fun by removing wheels and caster, so assemble with waterproof glue and screws. For use on icy hills, runners should be shod with ⅛ x 1-in. flat iron



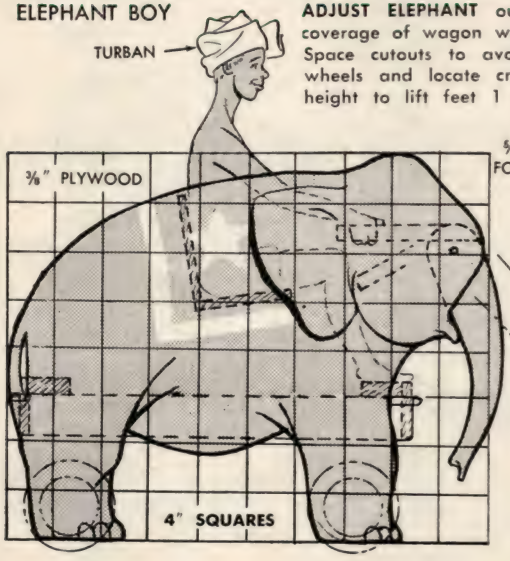

4" SQUARES
⅜" PLYWOOD, PAINT CROSS-FRAMING ON SOLID PANEL
1" DOWEL
⅜ x 14 x 16" BACK
22"
2 x 3
⅜ x 16 x 24" BOTTOM
4" WHEEL (2)
2 x 3 RUNNER, 35" LONG EXTENDS BELOW PLYWOOD
EYE-BOLTS FOR ATTACHING HARNESS LINES OR POLES
1½"
16"
3" RUBBER SWIVEL CASTER
1"
DOUBLE NUTS LOCK 4" WHEEL ON 4" BOLT
1"
2 x 3 DRILLED FOR EYE-BOLTS AND CASTER



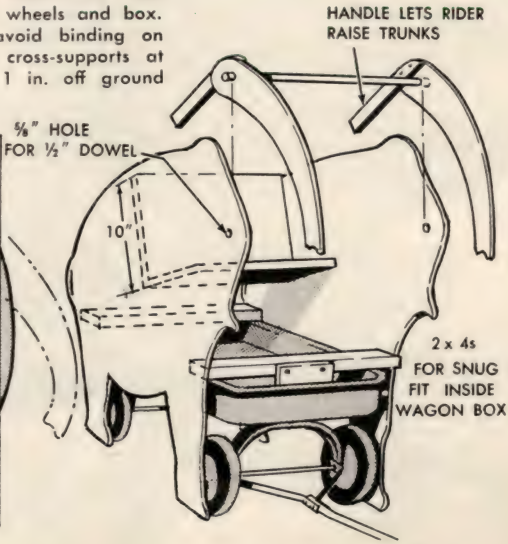
JUNGLE CAGE

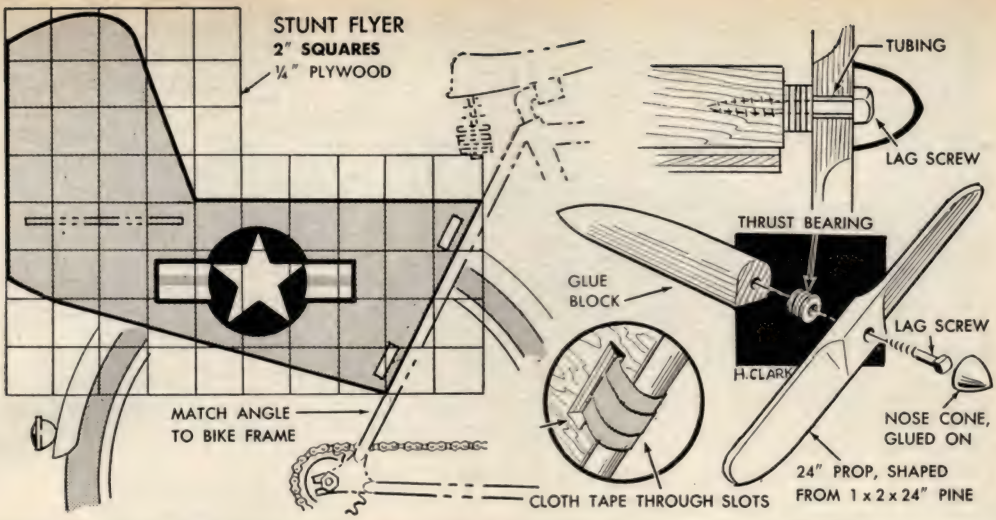
THATCHED ROOF lifts off for getting animal in and out of cage. Tiger-striped or panther-black cat is best. If you put in two Toms, they'll raise roof all by themselves

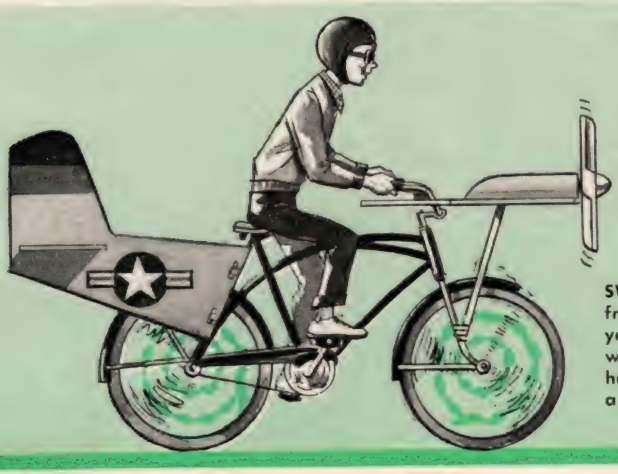
ELEPHANT BOY



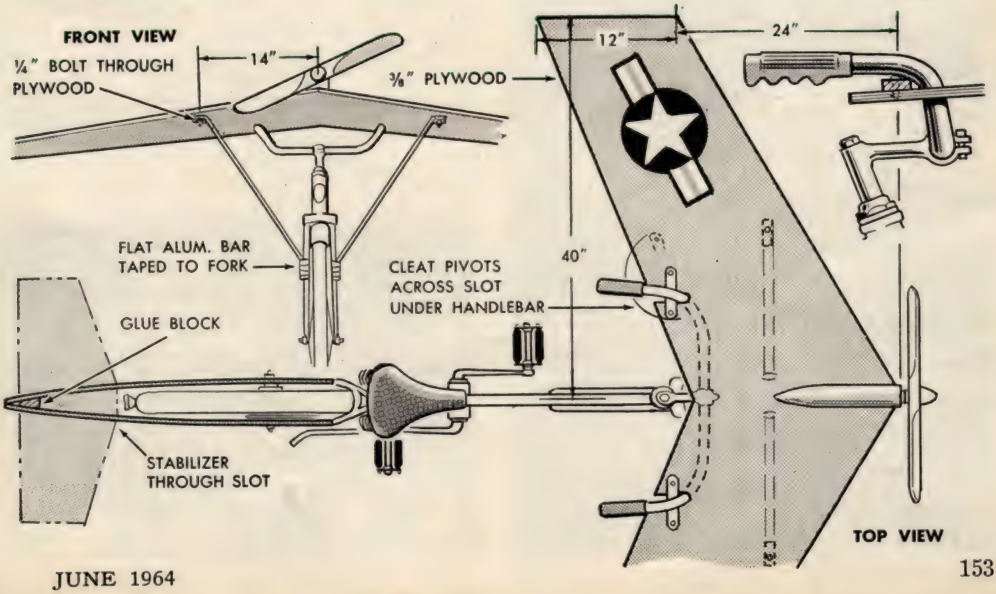
ADJUST ELEPHANT outline for best coverage of wagon wheels and box. Space cutouts to avoid binding on wheels and locate cross-supports at height to lift feet 1 in. off ground







SWEPT WING is supported on struts from steering fork; it bears on cleats you pivot across slots after dropping wing in place (detail below). If bike has flat handlebar, you'll have to bend a replacement from electrical conduit



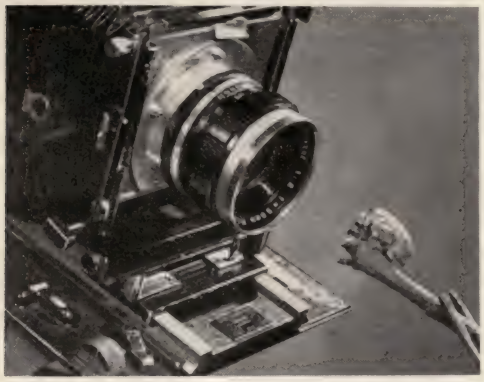
THREADED MOUNTING FLANGE is fastened to aluminum lens board with machine screws. If board is of thin wood, use wood screws and file off points

Try Your Miniature Lens on a Big Camera

MOUNTED on the lens board of a press or view camera, I found that a normal 50-mm lens of a 35-mm camera will permit extreme closeups of small objects.

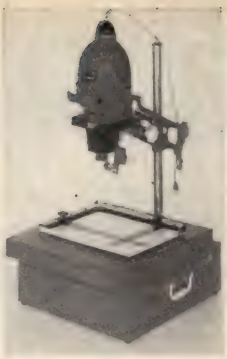
Easiest way to mount the lens is to consult a large photo dealer to see if a suitable mounting flange and lens board can be obtained ready-made. However, it's not very difficult to make these items yourself. The board is just a square of wood, hardboard or metal with a hole of the appropriate size, and the flange merely a threaded metal ring.

To avoid vibration, it's best not to use a shutter when taking extreme closeups, so I shoot in a darkened room, turning the lights on and off after removing the filmholder slide. Another good method would be to fire a flash bulb.—*B. W. Ervin*



ON PRESS CAMERA with double-extension bellows, lens from 35-mm camera focuses down to a few inches, makes cicada skin below resemble monster

SIDE VIEW of same insect skin picks up minute details with critical sharpness. Shutter was bypassed, as its magnified vibration could have spoiled the image



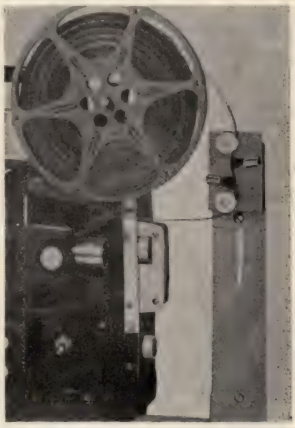
New for Camera Buffs

By Art Maher

CARRYING CASES of these portable enlargers also serve as bases. Model P 35 (under $70) comes with glassless 35-mm negative carrier, 2-in. f:4.5 lens and easel. The P 356 Color (under $100) has 35-mm and 2¼x2¼ carriers, 3-in. f:4.5 lens, easel and color head. Accura, 708 Byron Ave., Franklin Sq., L.I., N.Y.

THE 8-TO-1 LENS on Electric 8 zoom Reflex 8-mm camera proved very sharp in PM tests. Gives 6.5 to 52-mm focal lengths, for very wide angle and extreme telephoto shots. Drive is battery powered. Electric eye has sensitive CdS cell that reads through the lens. About $295. Eastman Kodak, Rochester, N.Y.

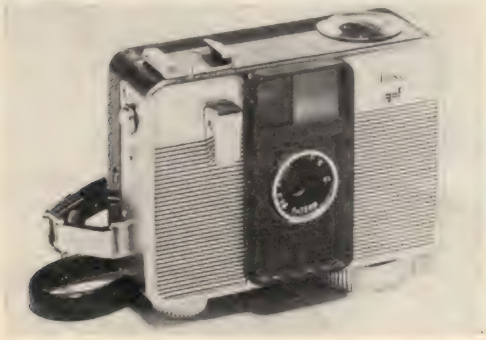
FILM CLEANER works with any 8-mm projector. It holds two specially treated camel's hair brushes against the film to remove dust and dirt electro-statically before the film enters the projector. The unit is priced at $9.95, retail. Available from Lindau Film Cleaner Sales, P.O. Box 483, Lake Forest, Ill.



3D MOVIES AT HOME: Third dimensional films can be shown on standard 8-mm projectors. The only special equipment you need are green and red spectacles, which come with the film. First title offered is "Spooks" ($4.95), which stars the Three Stooges. Columbia Pictures, 711 5th Avenue, New York, N.Y.

CLOSE-UP KIT No. 583 permits Polaroid 100 camera to focus down to 9 ins. Contains a flash shield, close-up lens and short-focus rangefinder adapter. Costs about $8.95. Another useful accessory is the No. 516 cloud filter (inset) that sells for around $4.95. From the Polaroid Corporation, Cambridge 39, Mass.

PURSE-SIZED CAMERA takes 40 pictures on a regular 20-exposure roll of 35-mm film, 72 shots on a 36-exposure roll. It has automatic exposure control, motorized film advance, three-zone focusing system. We tested the camera, found it handy to use and optically good. Under $70, with an attractive zipper case. From Ansco Photo Products, Binghamton, N.Y.



SATURDAY MECHANIC

Is a Clean Car Worth More?

Surprisingly, yes. And higher trade-in value is only one advantage of keeping your car spruce both inside and out—you may find it runs better!

By Morton J. Schultz

A SURVEY made of 20 new and used car dealers in the New York metropolitan area showed that all offered anywhere from $50 to $100 more to a customer on a trade-in or when buying the car outright if that car had been kept clean.

"By clean," one explained, "we don't necessarily mean the body. As a matter of fact, that's the least of our concern since we can get the outside of a car washed for $2. We look for cleanliness of the interior and engine compartment and, if the car is a convertible, of the top and rear plastic window."

These dealers explained that a clean car is usually a well taken care of car—one they can put on a lot and have little trouble selling. One dealer, however, was blunt enough to provide a dubious motive for wanting a clean car.

"My concern is cleanliness first—mechanical condition second," he said. "If two cars of the same model and year were offered to me, and one was immaculate

START WITH THE CARBURETOR, since it will be under wraps when you degrease the rest of the engine, later

but had a mechanical flaw while the other was filthy but mechanically perfect, I'd pay as much if not more for the clean one."

"Why?" was the natural question, so we asked it.

"We can always convince a buyer that a clean car is a creampuff throughout," he answered. "The public is funny in this respect. They have eyes. They examine the things they can see and, if clean, they convince themselves that the car must have been cared for mechanically as well. Anyway, many can't tell the difference between a wrist pin slap and the normal sound a running engine makes. Besides, we have ways of hiding a wrist pin slap."

"Wouldn't you be better off," we asked, "to buy the mechanically perfect but dirty car and clean it yourself?"

"Not usually," he replied, "because after dirt on an engine and stains on the upholstery have been allowed to accumulate for 50,000 or so miles, anything we do would look artificial and like a cover-up to a buyer. The car would look as if we purposely dolled it up for a sale and that we were trying to hide something. But a car taken care of from the beginning looks naturally clean. For some reason or other, a car purged of 50,000 miles of dirt all at once looks *too* clean, if that's possible."

Cleanliness has other benefits. Most of us are proud to drive a clean car or have one parked in the driveway. We don't feel ashamed when a relative or friend gets inside or when the gas station man lifts the hood to check the oil. The car might be three years old—yet it's clean and sparkling. It's the same pride we feel in having a clean, freshly painted house on a well-landscaped lot. Cleanliness of a possession is a reflection of our character. We want people to think we're neat and orderly.

Purging dirt has another beneficial side effect, especially with dirt on the engine. Layer on layer of oily crud on the block, valve covers and oil pan acts as insulation to hold in engine heat. There's little problem in cold weather, but during a hot summer day, dirt can make the difference between an engine that overheats and one that gets you home without stalls.

Jim St. John, a Somerville, N. J., mechanic, told us that the average driver is surprised to discover the harmful effects of engine dirt.

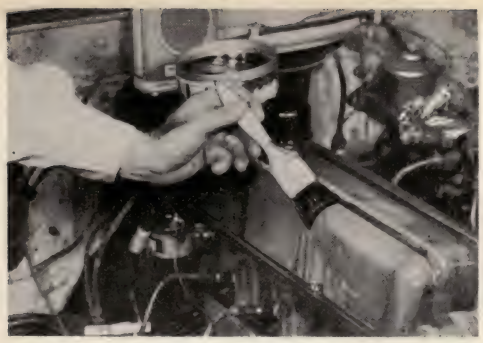
"I've seen engines run 25 to 50 degrees hotter than normal because of a blanket of dirt," he said. "Yet when we'd tell the customer that there was no mechanical basis for overheating—that he should have his engine cleaned— he'd look at us as if we were nuts."

Cleaning a car is not an easy task,

PLASTIC FOOD WRAP is best material to keep water from flooding carb during hosing operations. If water got into carb it would make car hard to start

SCRAPE OFF CAKED DIRT with putty knife, or wood scrap, to give liquid degreaser better chance to work. Don't dig deep enough to lift paint

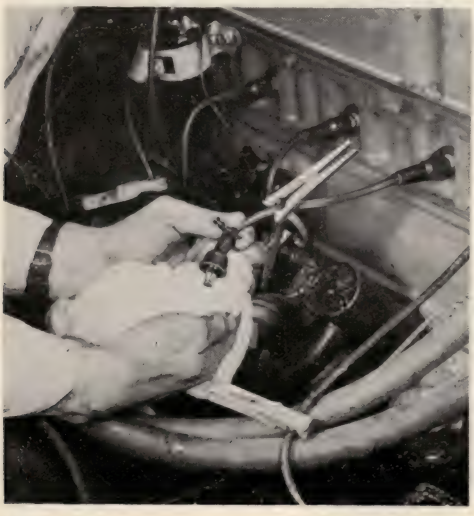
BEFORE DEGREASING, remove ignition wires from distributor and identify them by snapping a clothespin on each, marked with number of its terminal in clockwise order As rule of thumb, when you can write your name in oily dirt, engine needs cleaning



BRUSH DEGREASER on all engine parts you can reach —you'll know it's working when run-off takes on a pale white shade. Be sure engine isn't hot, since cleaner would then dry on contact and be of no value

STRONG STREAM of water, run over degreased engine, firewall and fender splash shield, flushes dirt away. If dirty spots remain after run-off, they'll need a new coat of degreaser and a new flush with hose

WIPE TERMINALS DRY before reinserting them into distributor cap. Cap, too, should be dried with cloth, paying particular attention to inside of towers. Reconnect wires in order of the numbered clothespins



although it's a lot easier than in the past because of new cleaning agents and new findings as to how old cleaning agents can be better used. It shouldn't take you more than a Saturday afternoon to get your car in tip-top shape and ready for the summer.

Start with the engine. The less dirt it has caked on it, the easier it is to clean, of course. But even if your engine is smothered by ½ inch of caked dirt, it can be cleaned.

Too many people think that the only way to clean an engine is with steam. This is not true. There are chemical solvents on the market, called engine degreasers or gunk, which do a nice job. Besides, these won't cause paint to flake off the engine block and valve covers, as does steam.

Remove the carburetor air cleaner and lay it aside for cleaning later. Now with an old toothbrush wetted frequently in kerosene or gasoline, scrub the outside of the carburetor body, all linkages, the choke plate and the carburetor throat.

Need we tell you that if you work with gasoline, you shouldn't smoke? It would also be a good idea to disconnect the battery ground cable to prevent any possible spark from igniting flammable agents.

As shown on the previous pages, you start with the carburetor first, then wrap it in self-adhering plastic film before you attack the rest of the engine. Scrape off as much caked dirt as possible, then prepare for degreasing by detaching the wires from the distributor. If you stick a tab of tape on the first terminal from which you pull a connector, you'll know this corresponds to the No. 1 identification you clip or tape on the wire itself. From then on, only the wires need labeling, as long as you remove and number them in a clockwise order. If you know the firing order of your car, of course, this memory-saver isn't necessary. But wires must be replaced properly to avoid misfiring.

Brush degreaser over the distributor cap first, using an old paint brush which has stiff bristles such as one that has been used for painting. Work the brush well between the terminals.

Apply degreaser over the rest of the engine and all its parts, including the starter, generator, radiator, water pump, battery and so forth. Degreaser usually has to be diluted with kerosene or gasoline, so read the instructions on the can. Let the degreaser do its job for several minutes, and then flush everything down thoroughly with a strong stream of water.

Complete the job by applying degreaser to the firewall and fender splash shields, following with a water rinse. If possible, borrow your service station's lift for a few minutes, raise the car and coat the

oil pan, transmission and other parts, if you wish, with degreaser followed by a water flush.

Reconnect the wires to the distributor, unwrap the carburetor and put the air cleaner back on the carburetor after dusting it off or giving it a water bath.

Maybe it took you a whole hour to do this job, but you've just cleaned your engine and saved $10 to boot. Now, we'll see what we can do about the interior.

Material used in a car's interior can be classified into one of two categories: fabric and plastic (or leather). Everything that isn't a plastic or leather material is considered fabric, although the latter might be composed of one or a combination of different threads, such as nylon, orlon, rayon, viscose or what have you.

General overall cleaning to remove dust and dirt is not a big problem if the interior has been taken care of from the start. Usually a dusting with a whisk broom or a vacuuming will do nicely. However, even a neglected car isn't too hard to clean.

A sudsy warm water neutral soap or artificial detergent (either powder or liquid) mixture can be used to clean either fabric or plastic. Just apply the suds to the upholstery, rub a bit, remove the excess with a clean rag moistened in clear water, and let dry. The type of soap or detergent you use is entirely your own choice. But keep one thing in mind with soap—never use any that you wouldn't use on your skin. In other words, stay away from the strong, alkalai type made for laundry and heavy-duty cleaning.

Should the sudsy mixture fail to do the job you want, then a stronger cleaner is called for. Every car manufacturer and many chemical outfits make these, and they're available at new car dealer showrooms, auto parts supply houses and service stations. For fabric you want a fabric cleaner which is a soapy foam but much stronger than ordinary soap. For plastic, you want a plastic cleaner that has cleaning chemicals in it. Some all-purpose cleaners can be used on both materials.

Fabric and rubber floor carpets are cleaned in the same manner, but make sure as much loose dirt as possible is vacuumed up. If there should be oil or grease spots on the mat that won't come off, you'll have to remove them with a volatile cleaner.

Eventually, every car owner gets his upholstery stained. Maybe one of the kids drips ice cream, or the wife drops her lipstick, or you accidentally touch the seat with a grease-laden hand. Stains such as these have to be handled differently than ordinary dust and dirt.

One important thing to keep in mind is this: a new stain is easier to remove

HOW TO REMOVE STAINS

Stain	Cleaning Agents	Cleaning Method
Blood	Cold water; household ammonia; corn starch and cold water paste	Rub with clean cloth saturated with cold water. If this fails to remove the stain, apply a little household ammonia with a rag or brush and follow with a cold water wash (wait about two minutes for the ammonia to do its job). If the stain is still there, make a thick paste from corn starch and cold water and apply to the stain. Let it set until dry—then pick it off and brush away particles. Keep applying until stain disappears.
Candy other than chocolate	Hot water	Soak a cloth in very hot water and rub the spot.
Chocolate	Lukewarm water; volatile cleaner	Rub the spot with lukewarm water and follow with a light rubbing of volatile cleaner.
Chewing gum	Ice cube; volatile cleaner	If the gum is soft, lay an ice cube on it until it hardens. Scrape off as much as you can with a dull knife or putty knife. If any remains, moisten it with a volatile cleaner and use the knife again while the spot is still wet.
Grease, oil	Volatile cleaner	Scrape off as much as possible with a dull or putty knife. Rub lightly with a clean cloth saturated with volatile cleaner. Make sure your rubbing motions are toward the center of the stain to keep the stain from spreading.
Ice cream	Hot water; volatile cleaner; neutral soap	Scrape off excess with dull knife and rub with cloth dipped in very hot water. If the stain persists, rub the spot with a cloth dipped in warm soap suds. Follow by rubbing with a clean cloth moistened in cold water. After this is done, rub the area lightly with volatile cleaner.
Lipstick	Volatile cleaner	This is the toughest of all stains to remove since lipsticks vary in chemical makeup. Scrape up excess with a dull or putty knife and follow with an application of volatile cleaner.
Nausea	Neutral soap; volatile cleaner	Sponge the area with a clean cloth saturated with cold water. Follow with a washing of neutral soap suds in warm water. If the stain remains rub lightly with a cloth dipped in a volatile cleaner.
Shoe Polish	Volatile cleaner	Water-soluble polishes (usually white) are easily removed by simply brushing them vigorously. Paste or wax polish can be removed with an application of volatile cleaner.
Tar	Volatile cleaner	Remove as much as possible with a dull or putty knife. Apply volatile cleaner, let it dry and use the knife again. Repeat as required.

SAFETY PRECAUTION when using any cleaning agent with toxic fumes (such as carbon tetrachloride) is to position electric fan to blow fumes away from you

than one which has set for a time, so wipe it up as soon as you can. Most stains, however, no matter how long they've been on the upholstery, can be removed—though it may take several applications of the cleaning procedure.

Before getting into cleaning of specific stains, a word is needed about one of the main cleaning agents you'll use—volatile cleaner. This is a dry cleaning agent, such as carbon tetrachloride or cleaning fluid. It has a strong, toxic odor, so make sure you always apply it out of doors and with all car doors open. Try not to breathe the fumes, but if you do, get away from the area immediately and into the air. A good way to dissipate the fumes is to direct a fan across the work, as shown above.

Keep another thing in mind when using a volatile cleaner—it's the cleaner that does the work and not you, so apply it with as little pressure as possible. Moisten a clean pad and rub gently in a circular motion. Don't scrub. If the cleaning has to be repeated, wait several minutes to let the cleaner you previously applied evaporate. This prevents it from penetrating to the sponge rubber padding below.

LIFT TRUNK MAT and suck up debris and dirt with hand vacuum cleaner. Dirt, here, soaks up moisture and holds it against body metal until latter rusts

Before applying volatile cleaner to a spot, it's wise to try it on a small hidden area to make sure the fabric won't discolor.

To remove specific types of stains from an interior, you should first identify the stain. If this is not possible, guess at what it is and use the method outlined for that stain in the table on the preceding page.

Cleaning a convertible top isn't too much of a problem. All you need is a can of powdered cleanser that foams when hit by water (like Ajax, Comet, Bon-Ami), a soft bristle brush and a water hose.

Rinse the whole top with water. Then apply the cleanser on an area of about two square feet in size. In other words, you'll do one small area at a time. Scrub the spot with the brush, adding water until the cleanser foams to a soapy consistency.

Mop up the foam with a cloth or sponge, examine the area and, if still dirty, repeat the operation.

After the entire top is cleaned, hose it down with plenty of water so all traces of the cleanser are washed away.

Make sure the top is absolutely dry before lowering it, since mildew and wrinkles can form on a lowered, damp top. Never use volatile cleaners or any bleaching agent on the top.

For years now, convertible owners have been plagued by unsightly staining of the car's rear windows. Oil is added to these at the factory to make them pliable enough so they'll fold over when the top is lowered. But sun, baking on the window, causes this oil to come to the surface and turns the window a brownish color. Things can be so bad as to ruin rear-view vision.

Many outfits have come out with so-called plastic cleaners that are supposed to eliminate the stains. Reports have indicated, though, that plain water does just as good a job—that is, it doesn't get rid of the stain but simply washes dirt away.

Credit has to be given to the Oldsmobile Division of GM for finding a new use for an old product. They have distributed a cleaner called GM Dry Cleaner to their dealerships for the past five years. This stuff was originally intended for cutting grime and film off a car's body. It was so expensive, however, that few dealers ever used it.

Maybe by accident, maybe by intent—it doesn't matter—Olds found that this cleaner does a great job on yellowed rear convertible windows. It's a fine abrasive that actually grinds away some of the top plastic, and the stain with it. It can be applied by hand or, better yet for a more thorough

(Please turn to page 196)

AUTO CLINIC

Q As you may know, the bumper and angle braces of the English Ford Prefect are weak and bend easily. Can you recommend a good strong bumper that will fit?—T.F.C., Mass.

A The only one we know of that won't change the appearance of the car is the bumper off a 1951 through 1956 English Ford Zephyr. They'll fit and they're a good deal heavier. The only problem is to find them—they are mighty scarce. As an alternative, why not take a page from the Volkswagen book? Put a stiffener into your present bumper or, if it's too badly beat up, get a new one (these are plentiful) and add a stiffener. The stiffener can be made from angle iron and inserted in the back of the bumper to act as the bumper blade. A metal or machine shop in your area should be willing to do the job for you at a reasonable cost.

Q I have a 1959 Chrysler Saratoga. Lately when I'm stopped and have my foot on the power brake pedal, the car idles very roughly. As soon as I take my foot off the brake, the idle becomes smooth. Any thoughts?—N.G.R., Calif.

A I think it's time you replaced the power brake unit. From your description, I'd say your rough idle is being caused by a bad part within that unit which, in turn, is causing a loss of vacuum. That's the reason the car idles smoothly when the brake pedal is released. Everything within the unit is disengaged and, hence, there is no interference with the engine's ability to produce vacuum.

Q I get an awful odor of gasoline from my 1962 Dodge Lancer after driving it at cruising speed these warm Spring days. It's also hard to restart within 15 to 30 minutes of stopping. Any advice?—M.L., New Jersey

A Lancer and Valiant owners, take heed! Both cars have extremely low hood lines. This traps heat so that it actually boils the carburetor, sending off a gas smell and creating a vapor lock condition that makes the engine hard to start. The problem, then, is built-in. But you might try getting rid of any fiberglas pad beneath the hood, to give the engine more breathing room. Some mechanics have even drilled a .015 hole in the fuel pump between the intake and outlet valves to relieve the pressure buildup. It helps, but it's risky because it invites fuel pump failure. There's no sure cure, short of hopping right out of the car after a drive and raising the hood to let the vapor escape into the air and to get some cool air on to the carburetor. This diminishes the gas smell and may help you restart.

The broader general problem of summer starts is our Saturday Mechanic topic in next month's issue.

Q My 1963 Rambler 550 Classic has had a mysterious engine miss since the day I bought it. The miss begins at 15 m.p.h. and can be felt up to about 35 m.p.h. Even a new factory carburetor modification kit, resistor ignition harness, new plugs and points, and re-timing haven't helped. Did I buy a lemon?—J.G.K., Michigan

A I doubt it—and I doubt you've got an engine miss. If you've done all this to that Rambler, look for your "miss" at the rear wheels. This Rambler is pretty light in the rear. If rear wheel balance is out of whack, road vibration can travel right up the drive train, through the transmission and directly to the gas pedal. It will appear as if the engine is missing when, in reality, it isn't. Have the rear wheels balanced.

Monthly Service Tips

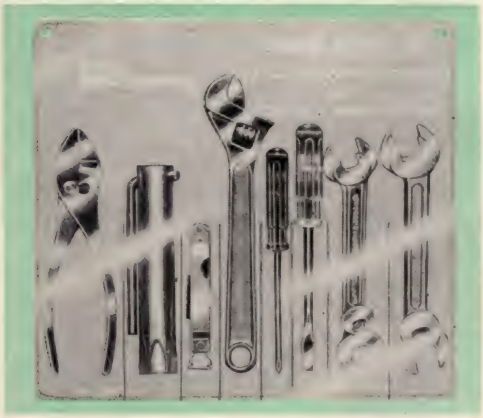
Chevrolet has issued a new set of ignition timing specifications for the 1964 Corvair, as a result of a recent re-evaluation of spark requirements.

On the 95-horsepower engine equipped with three or four-speed manual transmission, the new setting is 6 degrees BTDC, instead of the previous 2. Where this engine has powerglide transmission, the new setting is 14 degrees BTDC (it used to be 10). On all 110 horsepower high performance engines, the new timing is 14 rather than 12. These new specs don't apply to Corvairs with turbocharger.

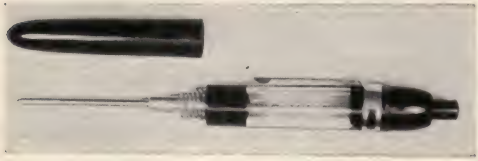
As a service to the readers of Popular Mechanics in solving problems relating to their cars or to driving in general, you are invited to submit your questions for answering either through this column or by mail. Address Auto Clinic, Popular Mechanics Magazine, 575 Lexington Avenue, New York, New York 10022

Shopping for Tools

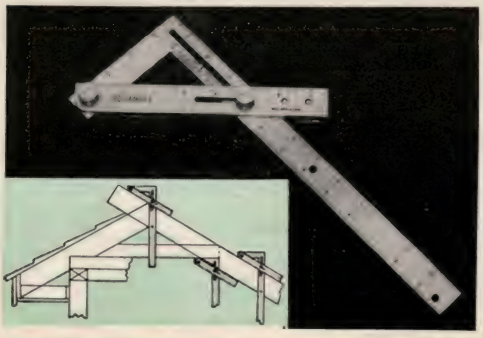
SMALL ENGINE REPAIR KIT includes pliers, adjustable end wrench, spark plug socket wrench, gap gauge, Phillips and standard screwdrivers, open-end wrenches—everything needed to service a power mower, snow blower, etc. Costs $4.95. Witherby Div., John H. Graham & Co., 105 Duane St. N.Y. 8, N.Y.



OIL DISPENSER rides in your pocket like a fountain pen. A push button at the top of the unit controls the flow of oil to avoid over-oiling. Long nozzle helps you reach parts that would be inaccessible to conventional oil cans. Retails for $2, postpaid. Order from Hollis Company, 1133 Broadway, N.Y. 10, N.Y.



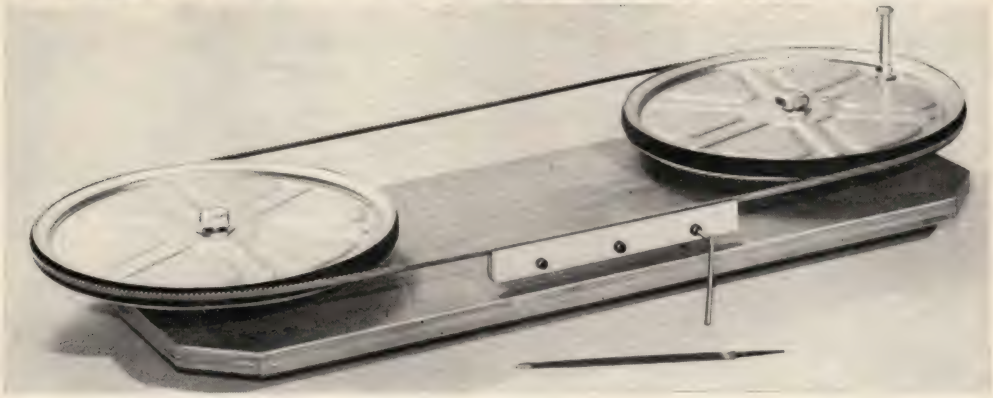
THE SQUANGLE can serve as measure, plumb, square, level or rafter scale. Particularly useful in framing a roof, as it speeds layout of ridge, tail and birdsmouth cuts (see inset). Also makes a good power saw guide. Available for $4.95, postpaid, from the Emmert Products Company, Box 221, Sycamore, Ill.



PORTABLE SANDBLASTER for use in home or small industrial shops costs less than $100. It's built around a 5-gal. butane tank that holds 60 lbs. of sand and is mounted on a two-wheel carriage. Will operate with a 6-c.f.m. or larger compressor. Made by Somes Mfg. Company, 610 West 17 Avenue, Spokane, Wash.

TIME SAVER: Delta 6-in. grinder is equipped with a brake that's said to stop the wheels almost instantly. Eliminates having to wait for the wheel to coast to a stop before adjusting tool rest, changing wheels, etc. In bench or pedestal models, from $180.50. Rockwell Mfg. Co., Rockwell Bldg., Pittsburgh, Pa.

FILING JIG FOR BANDSAW BLADES

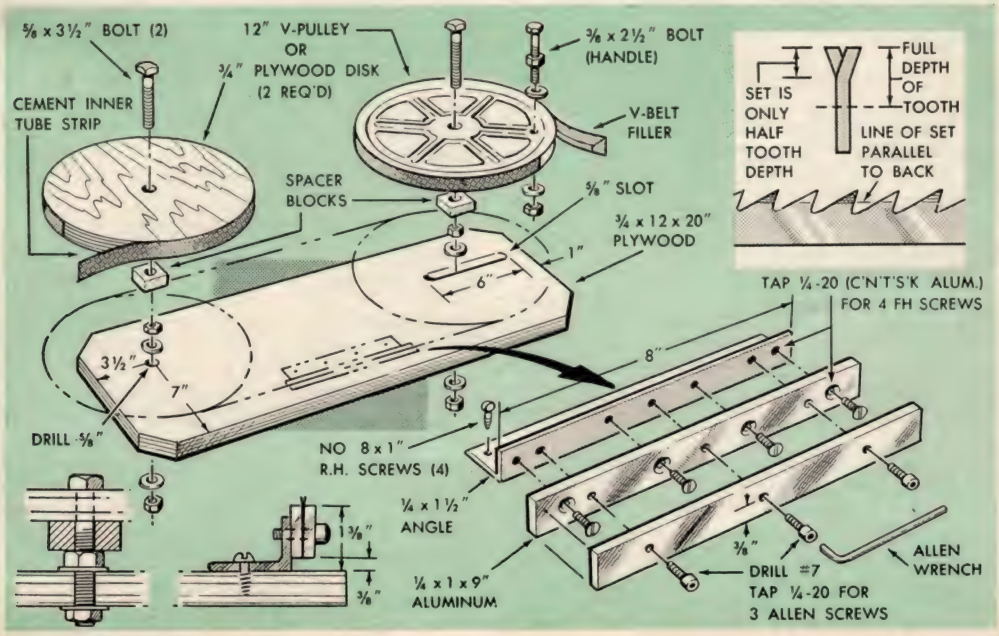


NOW you can restore the bite in the teeth of a worn bandsaw blade in jig time. As dimensioned below, the jig handles 83-in. blades from a 12-in. bandsaw. For blades of a different length, space the wheels to suit.

The stationary jaw of the blade vise is angle iron with one leg trimmed to a width of $1\frac{3}{16}$ in. and faced with aluminum as shown in the cross section. Three Allen screws clamp the movable jaw. After drilling through all three pieces, tap the holes in the rigid assembly and enlarge those in the movable jaw to $\frac{17}{64}$ in.

Use the jig across the corner of your bench so the projecting axles will clear. Or let the hubs serve as two legs, with the Allen wrench as a third.—*M. Banister*

TURN BLADE wrong-side-out for right-hand filing with 7-in. three-corner tapered file held like this



SMELTING FURNACE

ADJUSTING FLAME. Burners have separate gas valves for delicate flame adjustment. Single valve controls air supply. Sheet-metal box containing dry sand on which the molding flask is set, is placed near furnace

Twin-burner, gas-fired furnace, fed by air blast of vacuum cleaner, smelts up to 10-lb. charges of metals having melting points below 2000 deg. F.

By E. R. Haan

WITH THIS SMALL FURNACE you can smelt aluminum, brass and copper; pre-heat small, thick pieces of iron and steel for brazing or forging; casehарden soft steel; make up alloys and bake vitreous enamels on metals. You can use either LP or city gas. The cost is about $25.

The refractory lining: Build the refractory lining inside a sheet-metal can from 11½ to 14 in. in diameter, and from 14 to 17 in. high. Drill and ream two ¾-in. holes diametrically opposite each other as indicated. Then cut five pieces of firebrick to the sizes given for the furnace floor. To cut firebrick neatly you score it all around at a marked line by tapping a sharp cold chisel to form a groove 1/16 to ⅛ in. deep, and then sever with a heavier blow. The refractory lining consists of ganister and pieces of firebrick. Ganister is a mixture of equal parts of pulverized firebrick and either prepared refractory cement or fire clay. The mixture should have the consistency of rather stiff mortar. If you use prepared cement, you will need two 1-gal. cans. If you use fire clay, you add water sparingly. Broken pieces of firebrick usually can be had at little or no cost from a brickyard. Pulverize these with a hammer on a concrete floor.

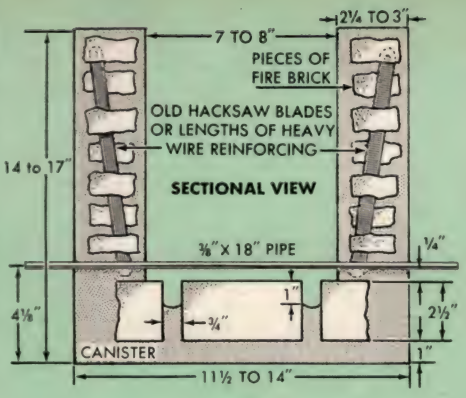
Cover the bottom of the can with ganister about 1¼ in. deep, and tamp it down to eliminate air pockets. Place the five pieces of firebrick in the positions shown, press them down into the ganister so that their top surfaces will be level ¼ in. below the holes in the side of the can. Press ganister into the spaces between the pieces of firebrick to come 1 in. from their tops.

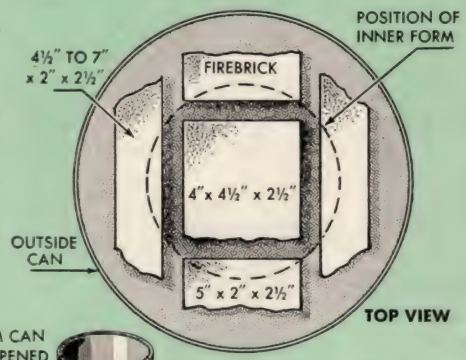
Next, make the cylindrical inner form of sheet metal. This is 7 in. in diameter for a can of 11½ to 12 in. in diameter so the lining will not be less than 2¼ in. thick. The inner form is 8 in. in diameter

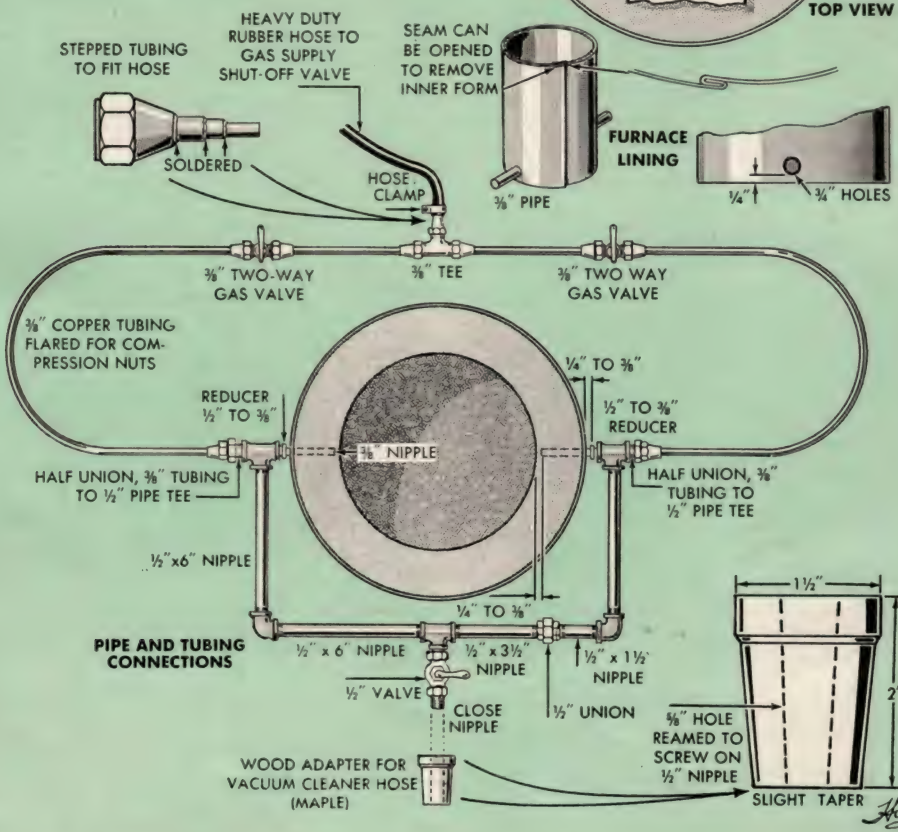
for a 12 to 14-in. can. Hammer the seam moderately tight so that it can be pried open for removal of the form. Drill and ream two ¾-in. holes diametrically opposite each other and ¼ in. above the bottom edge. Place the form centrally on the furnace floor so the holes are in line with those of the can, and push an 18-in. length of ⅜-in. pipe through all the holes.

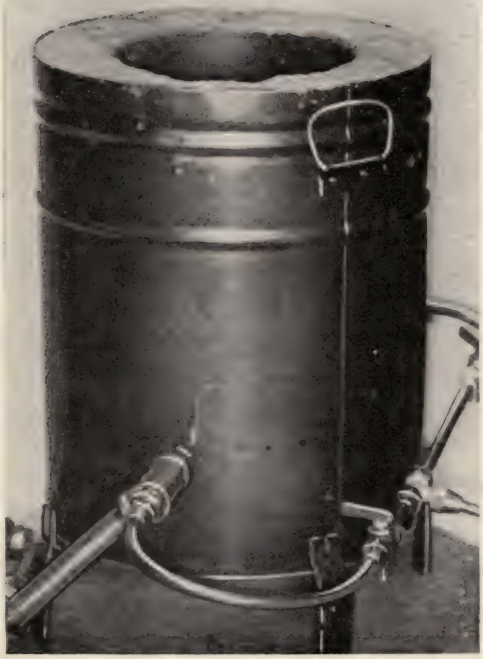
Now proceed to build up the lining. Set 8 to 12 lengths of wire or old hacksaw blades vertically at the center of the lining for reinforcement. Tamp the ganister into all voids and in good contact with the can, inner form and pieces of firebrick. After the lining has dried overnight, turn out the pipe and remove the form. Then let the lining dry out for three days. During this time you can make the burners, assemble the pipe and tubing.

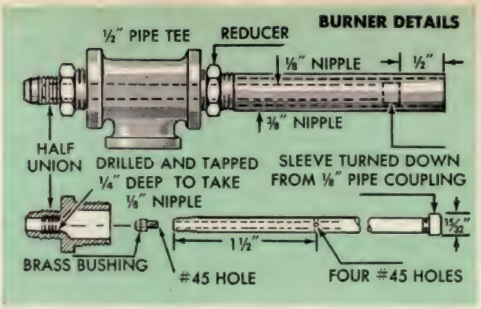
Burner details: The ⅜-in. nipples of each burner should come ¼ to ⅜ in. inside the surface of the lining. A similar amount of clearance is allowed between the reducers and the outside of the furnace. The brass half unions fitting the tees are the kind used to attach ⅜-in. copper tubing with compression nuts. Enlarge the inner part of the hole at the beveled end











TONGS GRIP crucible securely when removing it from furnace for pouring molten metal in molding flask

with a $^{11}/_{32}$-in. drill to a depth of ¼ in. To do this you mount the fitting at a true perpendicular in a drill vise and do the drilling on a drillpress. This assures getting the inner pipe nipple located centrally.

Tap the enlarged portion of the hole with a ⅛-in. pipe tap to take a nipple which should extend to ¼ in. inside of the end of the burner when it is assembled. The nipple has four No. 45 holes drilled equidistantly through its wall as above. A steel sleeve fits the burner end of the nipple and a brass bushing, drilled centrally with a No. 45 drill, fits into the other end of the nipple where it screws into the half union. In the absence of a metal-turning lathe, you can dress the sleeve and bushing to size on a drillpress, using a file.

Pipe and tubing unit: Use ½-in. pipe for the air supply line and ⅜-in copper tubing for the gas supply line. Compression fittings were used on the tubing in the model shown. For these the ends of the tubing must be flared carefully with a

SOME COMMON ALLOYS

Percentages indicate proportions by weight. Metals are given from left to right in the order of their progressively lesser melting points.

ALUMINUM BRONZE	Copper 90%, Aluminum 10%
BABBIT	Copper 3%, Antimony 7%, Tin 90%
BEARING BRONZE	Copper 82%, Zinc 2%, Tin 16%
BELL METAL	Copper 78%, Tin 22%
BRASS (yellow)	Copper 67%, Zinc 33%
BRASS (red)	Copper 90%, Zinc 10%
BRAZING METAL	Copper 55%, Zinc 45%
BRONZE	Copper 90%, Tin 10%
PEWTER	Copper 6.8%, Antimony 1.7%, Bismuth 6.5%, Tin 85%
SOLDER (tinman's)	Lead 33%, Tin 67%
SOLDER (plumber's)	Lead 67%, Tin 33%
TYPE METAL	Antimony 15%, Lead 82%, Tin 3%
WHITE METAL	Copper 1%, Antimony 19%, Lead 75%, Tin 5%

Melting points of above metals in degrees F.

Aluminum	1220	Copper	1980
Antimony	1160	Zinc	787
Lead	624	Bismuth	520
Tin	449		

flaring tool to produce tight, non-leaking joints. Each burner has a separate gas valve for individual adjustment of each flame but a single air valve serves both burners. Having the air and gas supplies connected midway between the burners equalizes the resistance of pipe and tubing.

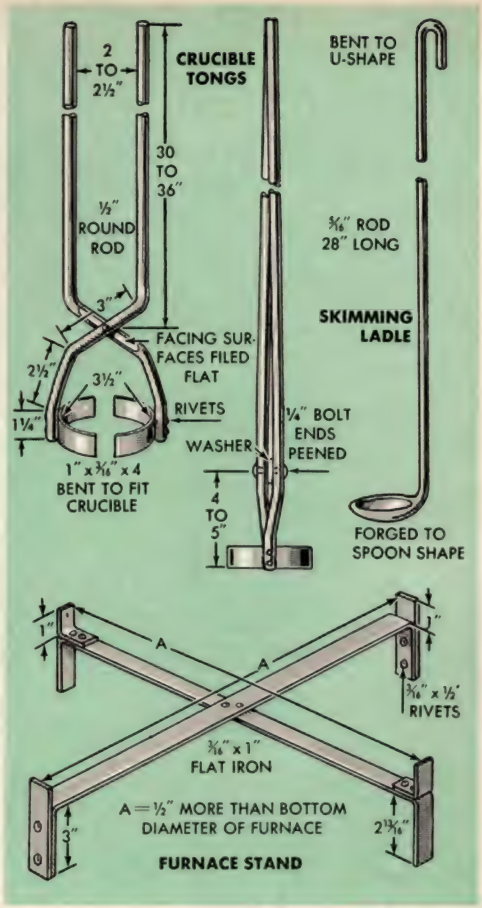
If the rubber hose for the gas line is too small to fit on ⅜-in. tubing, make an adaptor from short lengths of tubing, one fitting inside the other, then sweat-solder together. Also make an adaptor of close-grained hardwood to fit into the end of the vacuum-cleaner hose. Pipe-joint compound is used only at the tees where the half union and reducer screws into the tees, and where the ⅜-in. burner nipples screw into the reducers. All the joints of the gas line should be tested for leakage with thick soapy water brushed on when the burner is first used.

Crucible, tongs: A graphite-clay crucible is best but for economy you can use one made up from a malleable-iron pipe cap and nipple of suitable size. A 3½-in. pipe cap provided with a 6-in. nipple were used for the model shown. By providing the pipe cap with four machine-screw legs turned into tapped blind holes in the bottom to raise the crucible ½ to ¾ in., the flames will meet under it and the heat will be absorbed faster than if the flames contact only the side of the crucible. Curvature of the jaws of the tongs depends on the crucible diameter. The contact should be uniform and the tongs should be tested for holding power before being used.

Drying out the lining: After the 3-day drying-out period you ignite the gas and allow small flames to burn without any air blast for about an hour to complete the drying out of the lining. To ignite the furnace place a lighted match inside near a burner and turn on the gas supply slowly to produce a small flame. Then turn on the other burner to ignite from the first and turn it down for a small flame.

After an hour's time the air blast is used for about 10 minutes. First open the gas valves further so that the flames will rise above the furnace top. Then, while the air-supply valve is closed completely, turn on the vacuum cleaner, after which you open the air valve slowly until the flames become light blue. Too much air in proportion to gas will extinguish the flames. Avoid this by turning the gas valve almost fully open, then turn the air valve wide open after which you gradually decrease the gas supply to each burner to reach the point of maximum blast without flame flutter. After 10 minutes close the air valve first and then the gas valves to avoid a possible pop-back.

When the furnace has cooled you inspect



the lining for cracks which are almost certain to develop. Fill the cracks with prepared refractory cement or fire clay and allow this to dry out before the next firing. Crack filling is repeated if more cracks develop. When operating at maximum blast, the furnace can be covered almost entirely with a piece of asbestos-cement board to retain heat. To inspect the charge you remove the cover with a pair of tongs and observe the contents of the crucible through colored glasses. Use the skimming ladle to drop some borax into the molten metal. Use technical grade borax available at photo-supply houses. Skim off the resulting dross or scum before removing the crucible for pouring.

Safety rules: An LP gas tank should be located outside the building, and the gas piped through a ⅜-in. copper tube provided with one gas valve at the tank and another inside the building.

Locate the furnace on an earth or concrete floor that slopes away from walls or combustible material. The latter should

(Please turn to page 190)

FARM TIMESAVERS

Wagon Feed Rack

Feed is hauled and fed to my cows with this wagon-mounted rack. One load of forage is a day's supply for my 30-cow herd. The rack is made of 1-in. wire mesh and 2-in. lumber. In the field it is pulled behind the forage chopper when alfalfa is being cut. In rainy weather when hay cannot be cured the chopper and rack can be put to good use.

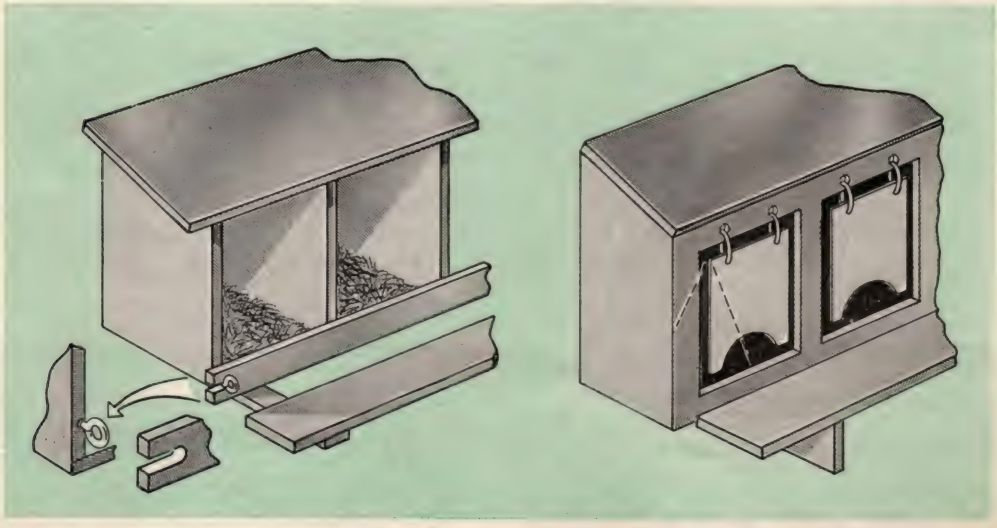
Pump-House Cover

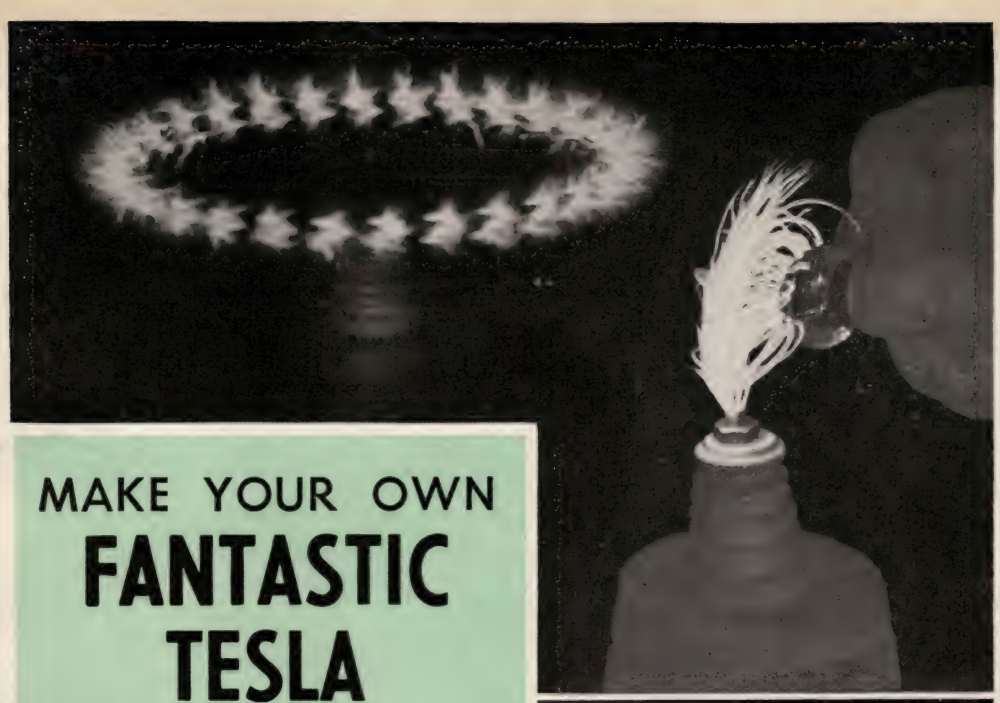
When I constructed this concrete-block, water-pump house for my dairy farm, I built an insulated cover and attached iron brackets to it to hold the cover in place. Should it ever be necessary to remove the water pump for servicing, easy accessibility is assured. The cover can be taken off in a few moments simply by unbolting the brackets. I then have room to remove the pump.—*Ed Holtkamp*

Two Poultry House Timesavers Worth Cackling About

A removable ledge board across the nesting boxes in the laying house speeds the job of thoroughly sweeping out the nests. It's nothing more than a 1x4 with a slot in each end. These slots fit over large screw eyes driven into the ends of the nest as shown in the drawing. By merely turning the screw eyes to either a vertical or horizontal position, the board may be held tightly in place or instantly removed when it is necessary to sweep out the nests.

Farmers agree that egg production may be substantially increased by darkening the nests so that the laying hens are not disturbed. If free-swinging doors are attached at each nest, the hens will be able to enter easily and remain undisturbed. The doors can be made at little cost from scraps of linoleum or pieces of hardboard. If a notch is cut at the bottom of each door as indicated in the drawing, the hens will quickly learn how to get in and out.





MAKE YOUR OWN FANTASTIC TESLA COIL

In the mind of the electrical genius it's named for, it was a practical transmitter—but our version is strictly for thrills

By Harold P. Strand

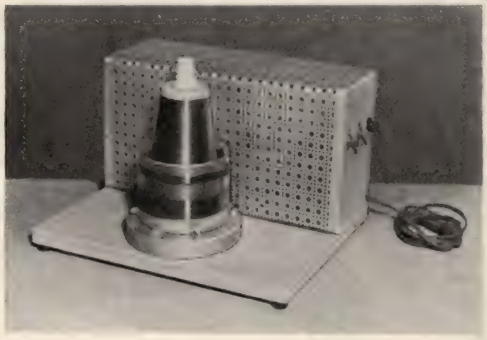
SPECTACULAR FIREWORKS include ring of fire scribed by wire pivoting on phono needle attached to terminal. Finer wire, attached directly to coil, produces trumpet pinwheels above (details page 172)

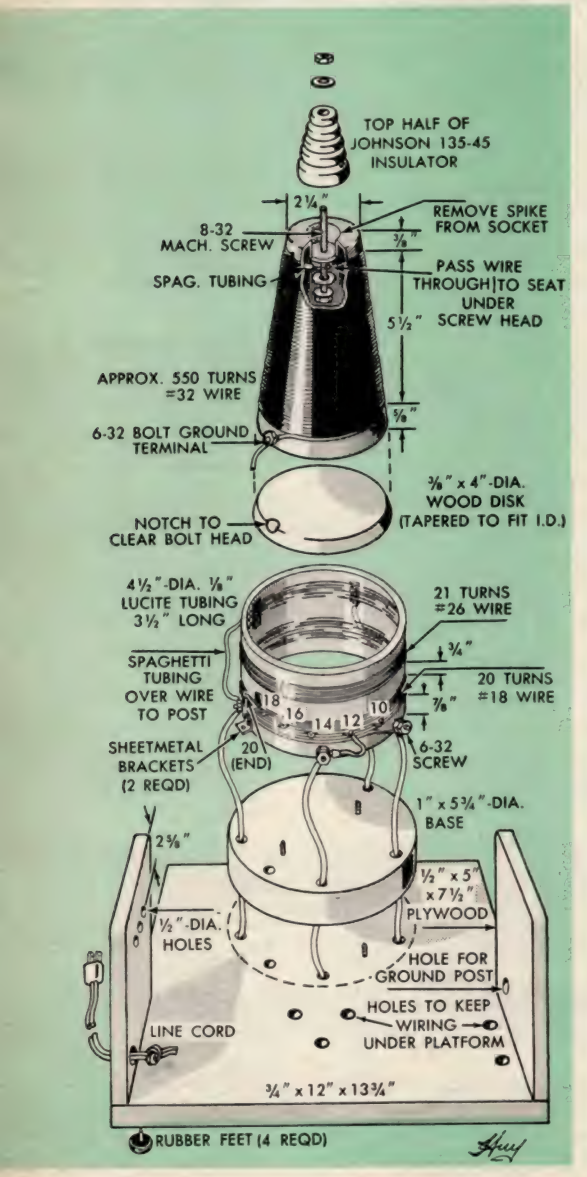
IT JUST SITS there spitting, like a fugitive from a mad scientist's laboratory. The current it's discharging—in a wicked, noisy two-inch brush—is of such a high frequency you can't measure it, but maybe it runs up to 40,000 volts! Feeling just a bit suicidal, you move a coin toward this geyser of fire. The greedy tenacles snatch toward it, seeking a path through you to the ground. You grit your teeth—but there's no shock.

Even if you poked a finger into the brush, the current would just splash over your skin. (Though there's still no danger of shock, we don't recommend direct contact: it might cause slight burns.)

Ever since Nikola Tesla invented a high-voltage, high-frequency coil, which he demonstrated before large scientific audiences both here and abroad, late in the 19th century, science experimenters have

NEAT HOUSING presents coil on platform with all wiring run underneath to transformer section behind perforated metal cover. Note switches on right side



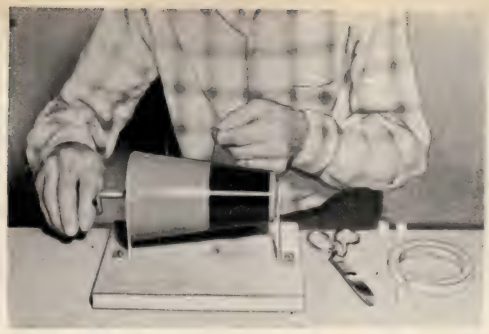


MATERIALS LIST

1 811-A tube
1 Ceramic 4-pin socket with oval mounting flange
1 9/16 ceramic plate cap
1 2500 or 3000 ohm, 25 watt Ohmite power rheostat with knob
1 3000 ohm, 20 or 25 watt fixed resistor
1 6.3 v. 6 amp. filament transformer. Thordarson 21F11 or equiv.
1 1000 v., 150 ma. plate transformer (avbl. surplus). With enlarged enclosure, stand- and Stancor PC-8414 power transformer, (1200 v., 200 ma.) can be substituted, using primary and these taps only
2 S.P.S.T. bat handle toggle switches with solder lugs, 6 amp. 125 v.
1 Finger knob panel type fuse mount for 3AG fuses
1 Box (5) 3AG fuses, slo-blow type, 2-4 amp.
1 5-way binding post
1 Line cord with plug attached
1 Johnson 135-45 insulator. Use top half only with 2½" 8-32 machine screw
1 Mica transmitting capacitor .0005 mfd. 3000 v. Type CM65
2 Mica capacitors .004 mfd. 2500 v. Type CM60.
Note: Values can be from .0002 to .001 mfd. for the CM65 and .002. to .005 for the two CM60's
1 Jones barrier terminal strip Type 5-140
1 Jones barrier terminal strip Type 2-140
About ¼ lb. #32 Formvar magnet wire
About ¼ lb. #18 Formvar magnet wire
About ⅛ lb. #26 Formvar magnet wire
1 ⅛" Lucite tubing 4½ O.D., 3½" long
1 Plastic conical vase (Carlisle Mfg. Co.)
10 ft. #33 or 34 Nichrome wire
10 ft. #18 or 20 plastic insulated stranded hookup wire
4 ⅝" rubber knob feet
Note: All above materials can be bought as a kit from Linwood Products Company, Box 186, Wollaston, Mass., for $39.50 (postpaid in U.S.)

ADDITIONAL NON-ELECTRONIC PARTS

1 ¾" plywood 12" X 13¾"
2 ½" plywood 5" X 7½"
1 ⅜" plywood 4" X 4" (cone disk)
1 Pine or other stock 1" X 6" X 6" (tubing disk)
1 Aluminum or other sheet metal 1/16" X ⅝" X 2½" (rheostat bracket)
2 Aluminum or other sheet metal .025" X ½" X 1" (tubing brackets)
1 Aluminum or other sheet metal .025" X ¾" X 4½" (capacitor clamp)
1 Perforated aluminum or sheet metal 13⅜" X 19¾" (enclosure)



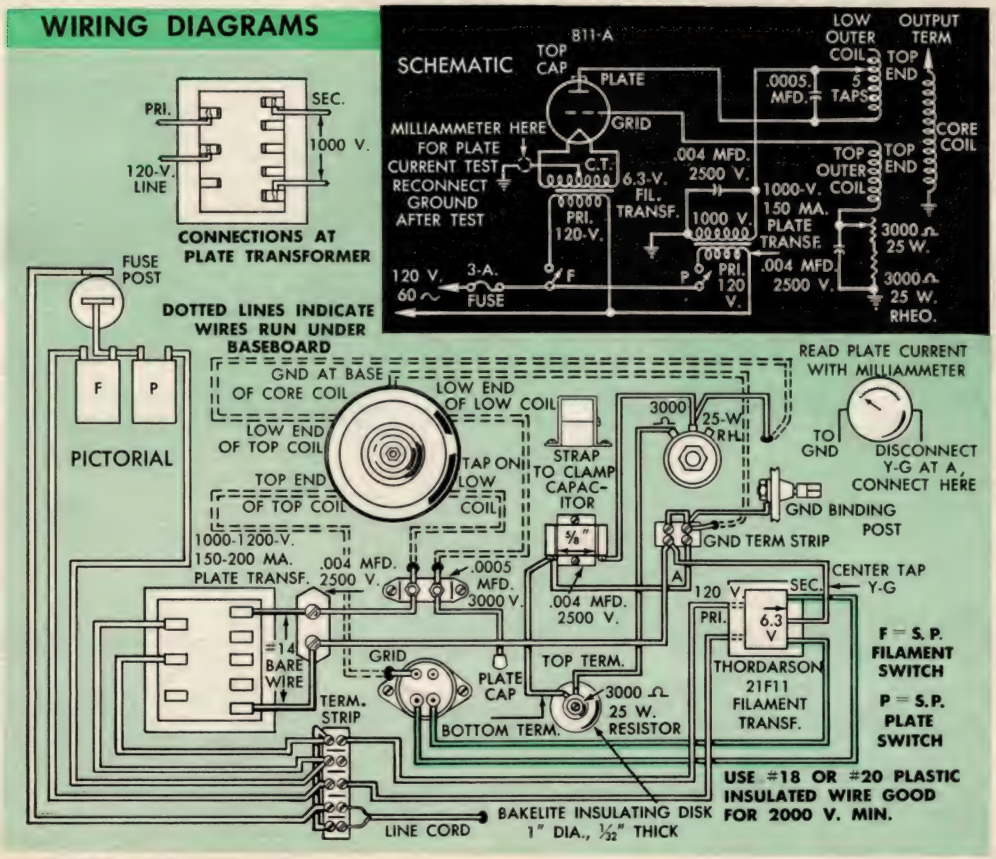
SIMPLE HAND JIG speeds winding of core coil on plastic-vase form. Crank is threaded rod secured through base disk with nut on each side, bent twice to form handle, suspended between two brackets

AFTER ASSEMBLY, read plate current by connecting D.C. milliammeter between center tap of filament transformer and ground. Adjust rheostat to 150 ma. maximum for any combination of capacitors and taps

been intrigued with their own variations on his coil. In Tesla's time, high-frequency current was obtained with an induction coil as a primary source of power and Leyden jars serving as capacitors, with a spark gap and the inductance of a second coil combining to form an oscillatory discharge of high frequency. With today's vacuum tubes and mica capacitors, we can make a much more efficient coil—and one that's safer to use.

Our small model operates at a resonant frequency of about 850 kilocycles, but this will depend somewhat on the tap selected on the lower outer coil, and the value of the capacitance used across it.

The coin stunt isn't even the best fun you can have with a Tesla coil. Wrap the center of a length of Nichrome wire around the terminal with the ends formed



SAMPLE EXPERIMENTS include (left) lighting a fluorescent tube by simply moving it into the high-frequency current field surrounding the coil; (center) lighting a 115-volt lightbulb without plugging it into a power line—by means of energy radiated to a sheet-metal plate; (right) passing the current from the coil's own brush discharge, through a metal rod taped on a plastic strip, to form duplicate brush at other end

out straight, like feelers. The ends become red hot and bright lavender sparks quiver along the wire as each half begins to rotate. Two fiery trumpets blaze forth in the darkened room. Just *why* the wire ends rotate is not known—maybe you can figure it out.

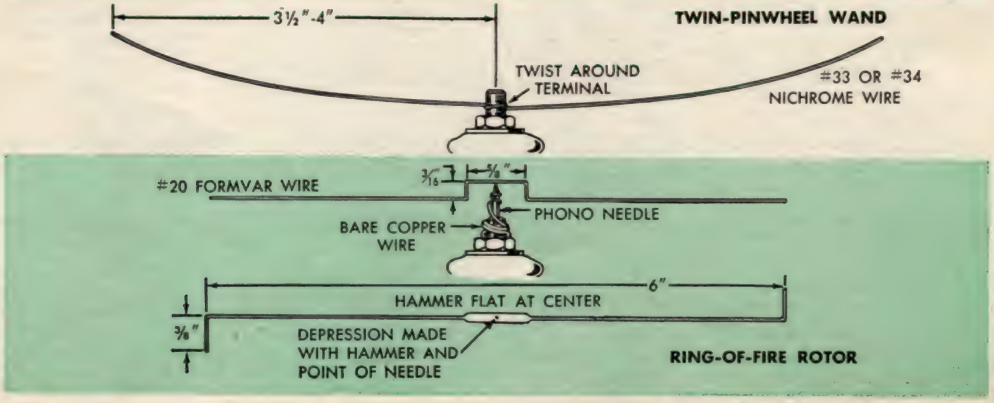
Another bit of fireworks results when you balance a wire rotor (detailed in the color panel, below) on the point of a phonograph needle erected on the terminal. Jet propulsion from the corona discharges at each end sets the rotor spinning. The result is a startling ring of fire.

Less spectacular, but no less intriguing, are the three demonstrations above. Holding a fluorescent tube near the coil activates the phosphors on the inside, causing a mysterious glow. Various types of neon lamps will also light when introduced into the coil's field. Since this field is strongest near the coil as you draw the lamp away it dims, then goes out.

The center experiment, above, illustrates Tesla's dream of lighting entire buildings from a distance without wires. As shown, you erect a sheet of aluminum on an insulating stand, to serve as a collector for currents radiating from the coil. Attach one clip lead to the plate and to one side of a small 115-volt lamp; another clip lead connects the other side of the lamp to ground. When the coil is switched on, the plate picks up energy and lights the lamp. The closer the plate is moved to the coil, the brighter the lamp glows. If you disconnect the lamp, you can draw sparks from the plate to your fingers, indicating that the plate is charged by radiation from the coil. Tesla did actually build a large coil apparatus in Colorado to test this idea, but it proved too inefficient for practical use.

Another experiment (not shown) demonstrates that this peculiar form of current seems to pass through material that's considered a good insulator. A piece of ¼-in. plastic, held in a spark gap connected from the top terminal and the ground post, seems to offer no resistance—you can watch the discharge continue to jump the gap. You can also conduct this experi-

TWO ACCESSORIES FOR SPECIAL EFFECTS



ment with other insulation materials of various thicknesses.

Start construction with the tall, tapered core coil. The winding form is a plastic flower vase with a stake base, sold in variety and garden stores. Be sure it's plastic—metal won't, of course, do. Remove the spike by pulling it out of its socket and drill a center hole through the socket bottom for a machine screw long enough to pass through the top insulator. At the large end make up a plywood disk with tapering edges, to exactly fit the opening. Drill three equally spaced holes through the edge of the vase for small escutcheon pins, driven into the plywood edge. Fastening is temporary, as the disk must be removed to make interior connections.

Bore a center hole in the disk to pass whatever axle you've devised for the winding process. One type of jig is shown in the top-left photo, page 171. An even simpler setup would be to pass plain rod through the form, cradling each end on a notched upright. The turning handle might be nothing more than a large nail tapped into the base disk, near one edge.

How to Wind the Core Coil

Apply a thin, even coat of varnish to the vase and let it dry enough to get tacky. Coil up about 2 in. of wire and tape it out-of-the-way at the upper end of the vase-form. Put the turns on in a single even layer with no overlap or space between. The tacky varnish prevents the turns from slipping out of place on the smooth, tapered plastic.

When you're within ⅝-in. of the edge, anchor the end of the wire with tape. The height of the winding should be about 5½-in.; that's roughly 550 turns—but it's not critical enough to warrant an actual count. At the top of the coil, bore a small hole just beyond the point where the turns end, to pass a piece of small-diameter spaghetti tubing. Slip this over the hole to the inside. Clean the end of the wire by holding it over a match a moment, then burnish with sandpaper before clamping it under the head of the insulator screw. Coat the head with quick-dry varnish or shellac to eliminate possible corona discharges here. Apply two or more even coats of varnish to the winding, letting each dry thoroughly.

The two outer coils are wound on the Lucite tubing without any sort of jig. The start of the lower coil has a permanent terminal; a second terminal provides a short lead that can connect to any of the taps. Two terminals are also provided for the ends of the upper coil, at the opposite side of the tube. For connections to these terminals, slip on pieces of spaghetti tubing where the wires cross the lower coil, and make sure the leads don't contact it, as shorting might result.

This disk is cut to a 5¾-in. dia. as shown in the exploded view, page 170, then positioned temporarily on the platform so you can drill holes (to pass the five leads) through both thicknesses at once. Center the core coil on the base disk and drive two flathead screws up through it, countersinking them flush. Now drop the outer coil unit down over the core coil (after cutting a notch in the tubing to clear the inner terminal).

Assembling the Power House

In the photo, page 170, the 1000-v. transformer is at the left and the filament transformer is at the right. The tube socket has been mounted with spacers so it will clear the bottom connections. The rheostat for the grid control is bracketed to the side. Use plastic insulated stranded wire with clamp-on terminal lugs at all screw terminals.

The milliammeter you use to adjust the plate current (top right photo, page 171) should have a scale of 0-300 or more. To hook it into the circuit, remove the center tap of the filament transformer from the ground and connect it to one side of the meter with a clip lead; another lead connects the other side of the meter to the ground terminal. If, when you turn on the power, the meter reads *down* scale, reverse the leads. To avoid shock, be sure all power is off before you touch any wires or connections around the coil. For maximum safety, you may want to fit a larger plastic tubing over the outer coil.

It's the Combination that Counts

The strong brush discharge shown in several photos indicates a good combination of capacitor value and the best tap on the low outer coil. You can experiment with various capacitor values and taps while adjusting the grid resistance to keep it within the 150-ma. limit for the plate current. When the best combination has been found, solder the lead to the tap selected. You'll have to scrape the varnish off each tap with a sharp knife and sandpaper before making any connection.

When operating the coil, be sure to turn on the filament switch first and let the tube warm up 15-20 seconds before you flip the plate switch.

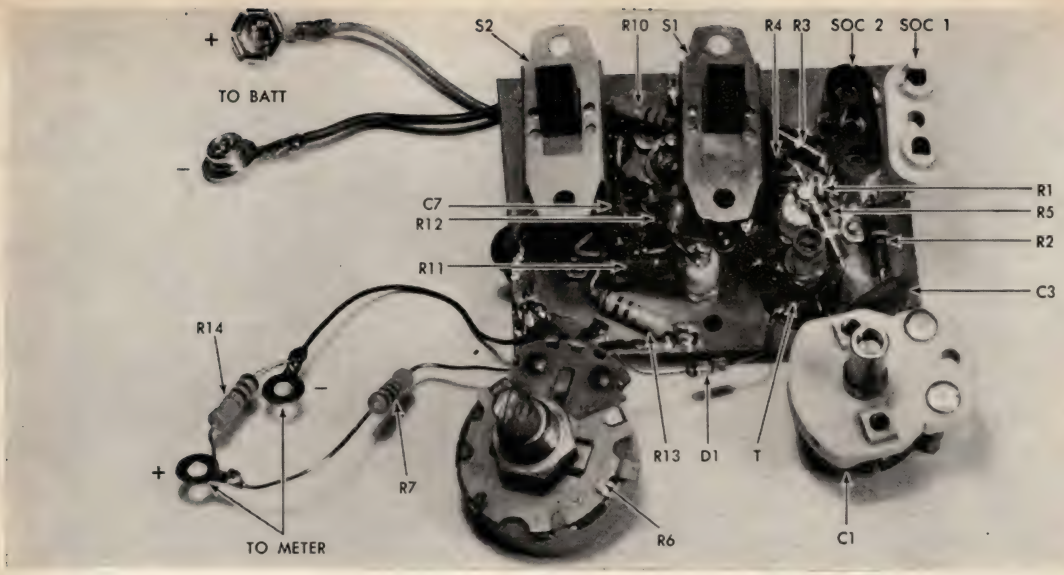
Note that a ground post has been provided at the opposite side from the switches. You can ground the coil with a clip lead to a water pipe or radiator. This post may also be required in some experiments requiring both the ground and high-voltage sides of the circuit. ★★★

SLIP A CB CRYSTAL into the appropriate socket, turn on the tester, turn the knobs and read the meter. Now you know how well that crystal is working

BEHIND the front panel. Note how larger components are fastened to the panel itself. Transistors and other small parts are mounted on subassembly

Double

TEST SET is being used as a signal generator here while a portable Citizens Band transceiver is adjusted for maximum receiver circuitry sensitivity



IN CLOSE on the copper laminate subassembly board. All the miniature parts are identified and their location indicated. Remember to keep all wiring as short and neat as possible, especially around the rf (radio frequency circuit)

Your CB Range

Use this pocket-size tester to check crystals and peak tune your Citizens Band receiver

By Leonard J. D'Airo

IS YOUR CITIZENS BAND set tuned? Are transmitting and receiving crystals hot? If not, the useful range of your set may be only a fraction of what it should be. Here's a little CB test set that will quickly pick out defective crystals and provide a portable signal source for tuning CB receivers.

The test set is completely transistorized and battery powered. To check a crystal, remove it from your CB set and plug it into one of the sockets on the tester's front panel. Turn on the power and adjust the *tuning* control until you get a peak reading on the meter.

With the *sensitivity* control set at mid-range, a meter reading of 25 or better indicates a good crystal. A reading much lower than 25 indicates a sluggish crystal that should not be used. If the reading is close to 25, turn the *sensitivity* control up to the ¾-turn position and recheck the meter. If it now reads less than 35, replace the crystal with a new one up to specs.

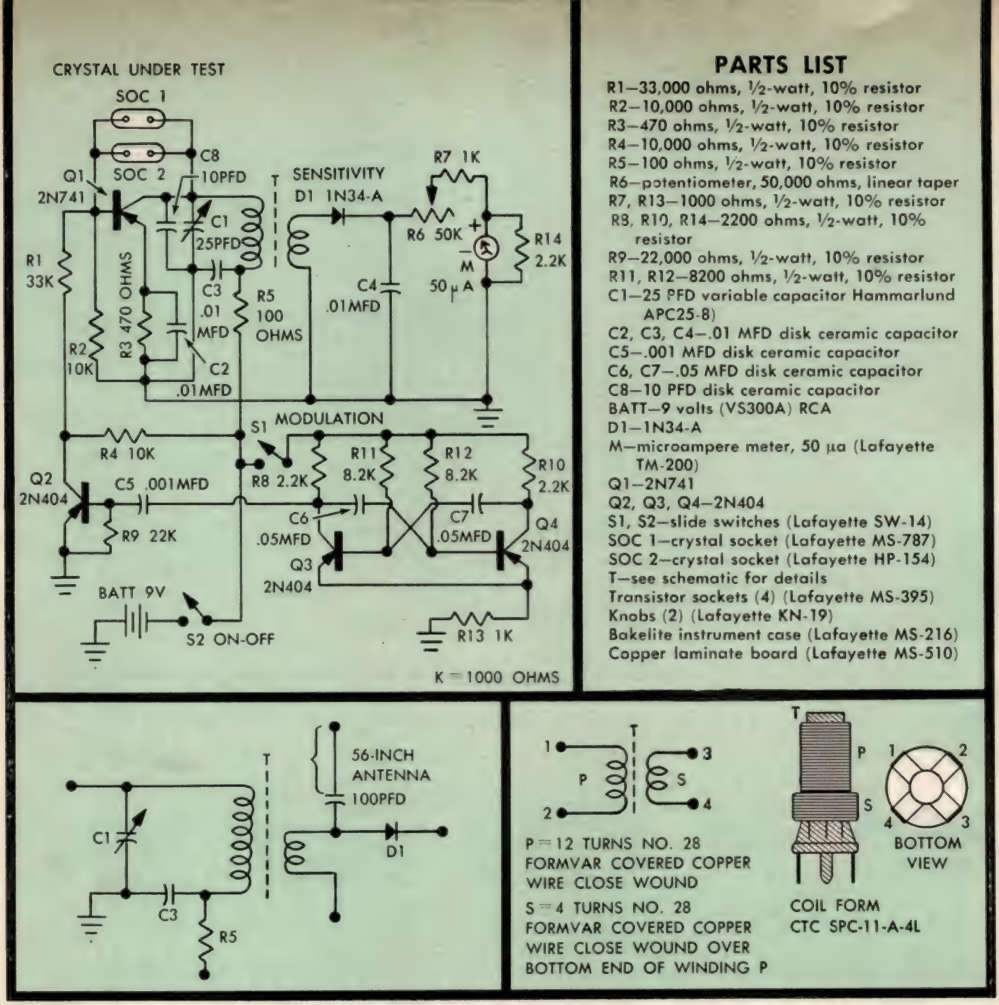
If the meter reading changes during testing without the controls being adjusted, the crystal frequency is shifting. Such a crystal should not be used.

To use the test set as a signal generator, turn on the power and set the *modulation* switch to *on*. Now insert a crystal for the frequency you want and tune the test meter just as though you intended to test the crystal.

Bring the test set near the CB receiver and you will hear a tone from the receiver's speaker. Tune your receiver for maximum volume and you will have set up your CB set for maximum receiving sensitivity and range.

Construction Hints

The entire unit is built into a 3¾ x 6¼ x 2-inch bakelite instrument case. Larger components (meter, switches, tuning capacitor, etc.) are mounted on the panel.



PARTS LIST

R1—33,000 ohms, ½-watt, 10% resistor
R2—10,000 ohms, ½-watt, 10% resistor
R3—470 ohms, ½-watt, 10% resistor
R4—10,000 ohms, ½-watt, 10% resistor
R5—100 ohms, ½-watt, 10% resistor
R6—potentiometer, 50,000 ohms, linear taper
R7, R13—1000 ohms, ½-watt, 10% resistor
R8, R10, R14—2200 ohms, ½-watt, 10% resistor
R9—22,000 ohms, ½-watt, 10% resistor
R11, R12—8200 ohms, ½-watt, 10% resistor
C1—25 PFD variable capacitor Hammarlund APC25-8)
C2, C3, C4—.01 MFD disk ceramic capacitor
C5—.001 MFD disk ceramic capacitor
C6, C7—.05 MFD disk ceramic capacitor
C8—10 PFD disk ceramic capacitor
BATT—9 volts (VS300A) RCA
D1—1N34-A
M—microampere meter, 50 μa (Lafayette TM-200)
Q1—2N741
Q2, Q3, Q4—2N404
S1, S2—slide switches (Lafayette SW-14)
SOC 1—crystal socket (Lafayette MS-787)
SOC 2—crystal socket (Lafayette HP-154)
T—see schematic for details
Transistor sockets (4) (Lafayette MS-395)
Knobs (2) (Lafayette KN-19)
Bakelite instrument case (Lafayette MS-216)
Copper laminate board (Lafayette MS-510)

COMPLETE CIRCUIT of the little test set (A). Be sure to select a crystal socket that will fit your type crystals. (B) How to hook up an antenna to the signal generator. (C) Detail shows how to construct transformer T

Transistors, coil, resistors and capacitors are all mounted on a 2 x 2½-inch copper laminate board. This subassembly is mounted to the panel over the crystal sockets and switches. Use 1½-inch standoff bushings to separate the subassembly from the panel.

The copper laminate board acts as a chassis, and components that connect to ground can be soldered direct to the copper foil. Sockets are used for the transistors and insulated ceramic standoffs for tie points for resistors and capacitors.

Parts layout is not critical, but take a bit of care when wiring the r.f. circuit. Keep leads as short as possible and run them direct. The photographs show the layout and construction details of my unit.

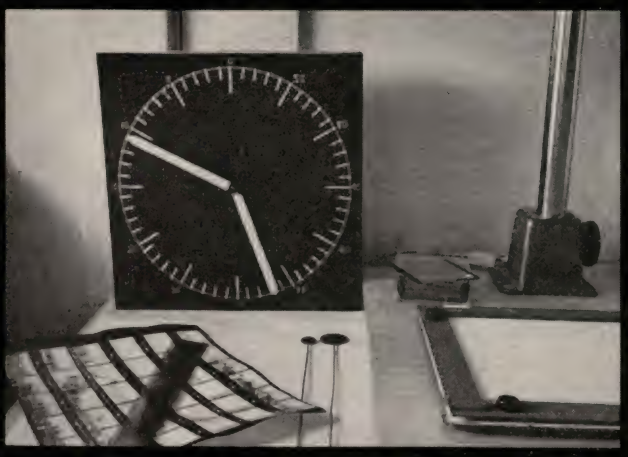
When you're finished wiring, double check for possible errors. Insert a 0–15 milliammeter in series with the negative battery lead (the negative meter terminal to the battery).

Set the tuning slug in the coil approximately three turns below the top of the coil form. Set the variable capacitor (tuning) with its plates fully meshed and the *sensitivity* control to its mid-range position. Now insert the 2N741 into its socket. Turn on the power and note the milliammeter reading. It should not exceed 3 ma. Now turn the power off and insert a known good CB crystal into the test socket and turn the tester back on.

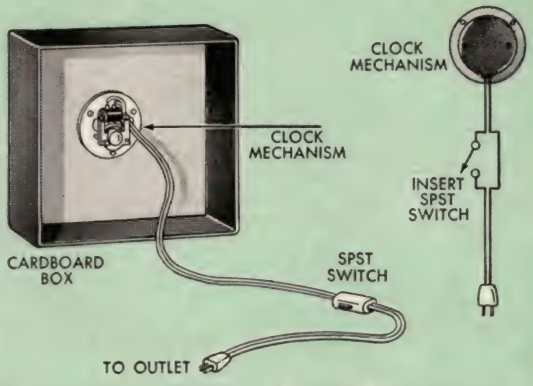
Turn the *tuning* control clockwise. The milliammeter reading should increase to 6–8 ma. and then suddenly drop to 3 ma. or less. If you don't get such a reaction, try another 2N741. If it doesn't help, recheck your wiring.

With this test set on hand, you'll always be getting the most from your CB gear. There's nothing better than a hot crystal and a peaked receiver. ★★★

Thrifty
Darkroom Timer



FINISHED TIMER can be placed in any convenient spot in your darkroom. Here it is being used where owner makes enlargements. You will also find the timer helpful when developing film



CLOCK MECHANISM is mounted in a case made from heavy cardboard. An ordinary spst a.c. line switch is added in the a.c. cord as an on-off switch. The unused hour hand is removed from the clock mechanism

AN ELECTRIC CLOCK with a sweep second hand is the important part of this timer. Remove any housing around the clock mechanism. Set it aside till later. Next make the timer case. I used heavy cardboard. Size is up to you.

When the case is finished, mount the clock mechanism in the case. Use small bolts, sheet-metal screws, or if there is no other way, epoxy cement. Now cut out cardboard hands and slip them over the sweep second, and minute hands of the clock. You can remove the hour hand as it is not needed. Luminous paint on the hands makes them easy to see.

Dial markings are also painted on with luminous paint. They should be numbered counterclockwise. This is a convenience in the darkroom. The minute hand can be set on 5 or 10, for example, and it will reach zero at the end of developing time when handling film. For print developing, use the continuously running second hand.

One important point: When developing film keep the clock as distant as possible from the unprocessed film. Light from the luminous paint is faint, but it can fog film if it is too close.—*Joe Hazen*

New in Electronics

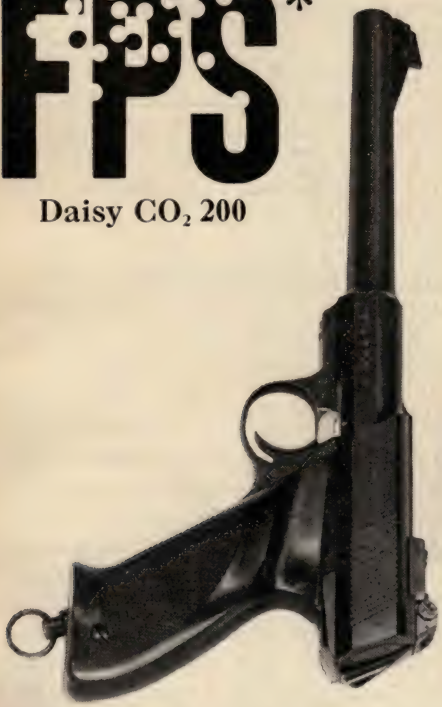
TWIN GLOBES OF SOUND, one at either end of this revolutionary hi-fi console, are more than just decorative end pieces. The spun-aluminum spherical speakers rotate freely outside the equipment console so the stereo sound can be balanced to match the acoustics of any room. The unusual outboard design isolates the speakers from the rest of the transistorized Clairtone Project G system which includes a stereo amplifier, AM-FM stereo tuner and record changer. Price tag on Project G is a staggering $1600

WHAT'S GOING ON in the air? It's easy to find out if you've got a Regency Flight Monitoradio. This set tunes in all the aircraft action on the radio waves between 108 and 136 megacycles. Automatic squelch circuit keeps the audio off unless you're actually listening to a broadcast. Model AR-132 $59.95. Deluxe model AR-136 (illustrated) $79.95

HYBRID HIGH-FIDELITY receiver combines the best features of transistor and vacuum-tube circuitry. For utmost efficiency, only transistors are used in the 110-watt amplifier section, keeping heat to a minimum and reducing power requirements. In the AM and FM-stereo sections, vacuum tubes result in high sensitivity and low noise. An automatic indicator turns on when stereo broadcast is being received. The Pilot R-1000 receiver sells for $449.50

400 FPS*

Daisy CO_2 200



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(A) Upholstering furniture (B) Attaching TV antenna (C) Insulating (D) Valances (E) Window shades (F) Weatherstripping (G) Recovering card table and chairs (H) Installing carpeting

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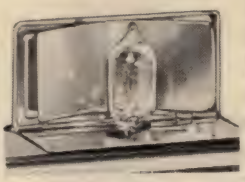
- **So complete, so automatic, you can shoot a whole cartridge of film on one winding without ever taking this camera from your eye...**

Loads instantly. You never handle the film. Drop a KODAPAK Cartridge into the camera, close the back, and the camera's loaded. The film cartridge is lighttight—you can load or unload in bright sunlight. When you've finished a cartridge, there's no rewinding. Just drop it out and drop in another!

Spring-power drive. A few pulls on a tape concealed in the bottom of the camera winds the spring and stores up enough power to shoot an entire cartridge of film . . . as fast as one frame per second if you wish. The motor automatically positions the first frame, advances the film after each exposure, and automatically winds off the trailer after the last exposure.

Superimposed-image rangefinder. You'll see the image right in the center of the viewfinder. As you focus, two bright images merge into one. At this point, you're in perfect focus and sure of a clear, sharp picture. Your lens is a fast KODAK EKTANAR *f*/2.8, and shutter speeds run up to 1/250 second so you can freeze fast action.

Automatic flash-exposure control. When the light is too dim for a good exposure, a needle in the viewfinder signals you that it's time to use flash. A flick of your finger releases the built-in flash holder. This action automatically sets the shutter at 1/30 of a second and engages the automatic flash-exposure control. Then, as you focus, you automatically set the lens opening for the correct flash exposure. No flash bulb guide numbers to remember. No figuring and refiguring to do with every flash shot.



From loading to shooting to unloading, the KODAK INSTAMATIC 800 Camera makes photography completely automatic. It leaves you free to concentrate on getting the finest pictures you've ever made. Black-and-white and color prints, or color slides.

Dropping in the KODAPAK Cartridge automatically sets the camera for the correct ASA speed of the film you're using. Film name and exposure number are always in plain sight through a window in the camera back.

For perfect exposure, a photoelectric cell reads the light—then *automatically* computes and sets the lens opening. If

camera: the KODAK INSTAMATIC 800

the shutter speed is set too fast for correct exposure, the shutter *automatically* slows down after the lens opens to *f*/2.8. After the exposure, the shutter returns to its original setting.

For unusual subjects, a manual control lets you increase or decrease exposure by one full stop. Release the control and it returns to neutral position *automatically*.

If you're out to own the most advanced camera you can, see the remarkable KODAK INSTAMATIC 800 at your Kodak dealer's. Complete with batteries, flashguard, and adjustable neck strap—less than $130.

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MAC'S

MAC'S SUPER GLOSS CO., INC.
Los Angeles 42, Calif., Cincinnati 26, Ohio

Home Fire Escape

(Continued from page 145)

Of course, the real value of any alarm system depends on how efficiently you've trained your family to *use* those precious extra minutes the warning gives you. You should all know a few basics about emergency procedures. Wherever practical, you should sleep with upstairs bedroom doors shut. By the very nature of a two-story home's construction, its stairway is a chimney for heat and smoke. The door provides a barrier that can save your life.

If you awaken to the alarm and find the door hot to the touch—*don't open it*! You may be felled by the rush of searing gases that have built up behind it. It's always wise to have provided an alternate escape route out the window of principal upstairs bedrooms. You can buy a rope ladder or make one of the several types detailed in *PM*'s June, 1962 issue. But these require some special treatment if you want to conceal that ever-ready coil you must store inside the escape window. The advantage of the folding ladder shown on page 145 is that it's ready for instant use, yet remains out-of-the-way on the outside of the house. Assemble it on the ground, using 4-in. strap hinges to attach the 2x4 sides to opposite faces of 10-in.-long 1x4s. Secure the low-folding side to the house wall with lag screws, and provide a screw-eye to which the raised side can be tied. Then, should that warning bell ever sound, break the tie-cord for a fast exit. ★★★

Smelting Furnace

(Continued from page 167)

be kept a safe distance from the furnace. A sheet-metal box about 6 in. high and about 3 ft. square, two-thirds full of dry sand, should be located next to the furnace. The molding flash is set on the sand. The crucible is held over the sand box on its way to the molding flask for pouring. With this arrangement any spilled metal will be confined safely. Surplus molten metal can be poured into a depression in the sand; it should not be left in crucible.

Wear asbestos gloves when handling the crucible tongs. It's a good idea to have an asbestos apron and to protect the face and eyes with an appropriate mask against possible splattering of molten metal. When adjusting the flame keep your face a safe distance from the furnace.

Casehardening: Place pieces of soft steel in a crucible, burying them in fine-powdered bone charcoal or potassium carbonate. Under high heat, steel absorbs carbon. Then you brush off scale, reheat cherry red and plunge in cold water. ★★★

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1662 River Road, Shelton, Connecticut

Owner's Report—Dodge Dart

(Continued from page 82)

"Low profile of hood gives excellent visibility."—California designer.

Unhappily, the trend is now in direction of high, boxy hoods which are harder to see over. Let's hope Dart keeps its slope.

"The visibility at the corners of the windshield is much better than on Falcon."—Florida service representative.

Complaints again were found ranked among the praises. Here are numbers six through ten that disappointed owners:

"Bad wind noise in left front door which garage can't seem to fix."—Idaho professor.

"Wind noise is too loud at highway speeds."—Oklahoma Army officer.

"I have a bad carburetor; the car won't idle and stalls in bad weather."—Ohio truck driver.

That stalling may be carburetor icing which some cars beat by routing heater water close to or through the carburetor.

"Having trouble getting the carburetor adjusted and car stalls frequently."—Virginia policeman.

"Front brake shoes dragged on my car."—California engineer.

"I had to have the large brake shoes and drums turned down at 500 miles and they still squeak."—Ohio policeman.

"I've had the brake drums tuned and they still pull to the right."—Washington ambulance driver.

"Gas intake is in the wrong place. Every time I get gas it spills. Finish is already dulled."—New York machinist.

Dart's horizontal "spit-back" filler pipe has been gleaning justifiable complaints for four straight years.

"Gas fill cap is part of the body so gas is easily spilled down the fender."—California physicist.

"I've been getting some water leakage around the windshield."—New Jersey banker.

"My GT hardtop leaks around windshield and rear window."—Maryland anesthetist.

Nobody expects a submarine when he buys a car but at least they could be as dry as a good umbrella.

"When it rains, a leak shows up under the dash."—Florida landscaper.

But still more compliments come from PM's owners. Here are 11 through 16 in order of their frequency:

"My wife can park it with great ease and all four corners are in sight."—Maryland farmer.

"The car handles nicely without power steering and has good pickup."—Retired Pennsylvanian.

True. Dart doesn't need power to lessen steering effort, but it's worthwhile for some as it provides quicker action.

"This is a solid car—stable, comfortable and secure."—Alabama physician.

"We have no posted speed limit and at relatively high speeds the car performs and handles like a much heavier car."—Nevada supervisor.

"The Chrysler service contract appears ideal."—New York accountant.

"The three-speed automatic shift (as opposed to the two-speed) makes the engine seem bigger."—Virginia engineer.

And what's more, it gives Dart an edge in economy, too.

Finally, here are numbers 11 through 16 of owners' most frequent complaints:

"In damp or rainy weather it's always stalling."—New York musician.

Carburetor icing again. Dart could use a snorkel to bring exhaust manifold-heated air to carburetor.

"I've been bothered by a few rattles; one sounds like a seat spring or rubbing metal against metal. It's hard to trace."—Michigan foreman.

"It's difficult for me (6-1) to get out of the seat, but other cars in this class aren't any better."—Vermont aviation official.

"Weld seams were not filled in to make a smooth body surface."—Virginia supervisor.

"Factory workmanship was poor on my Dart hardtop; it leaks."—Ohio office manager.

"The car needs more padding to kill the sound from the valves."—Florida barber.

"The three speed (manual) transmission isn't too good. It sticks in First."—New York butcher.

That wraps up our assortment of pros and cons gleaned from Dodge Dart owners who have run up a total of 1,488,585 miles on their cars. ★★★

Mars Flat?

Mars may be flatter than scientists had thought. A radar study carried out during one of the planet's recent passages close to earth showed light and dark areas along the entire northern 13th parallel of Mars. Light areas may indicate smooth reflections given off by flat surfaces; dark areas could be either material that does not reflect well, or broken mountainous terrain.

An area some 250 miles wide was surveyed in the study, which was conducted at California Institute of Technology's Jet Propulsion Laboratory. The planet was only 62.4 million miles away during the study.

1016 C

GONE FISHIN'

McCulloch's new lightweight fishing outboards are eager to get going. All four of them take to the water as economically as a quartet of young ducks. In fact, you start saving money even before you start the motor. Why? Because with McCulloch, you add just six ounces of oil to five gallons of fuel—*50 to 80% less oil than conventional outboards need.* You get the advantage of McCulloch's 100:1 fuel/oil ratio on the 7½, 14, and 28 horsepower models. All but the 3½. When it comes to size and weight, the 7½ hp motor is as easy to carry as a set of golf clubs. It stands only 30" high, weighs just 39 pounds, yet puts out more power per pound than any other 7½. You can choose either weedless or standard prop to do the job. To keep you fishing in comfort and safety, there's Bail-a-matic® to pump your boat dry automatically. It's standard on all models except the 3½. Lest you feel sorry for our 3½, it boasts a stainless steel water line, choice of direct drive or gearshift, and weighs only 36 pounds. Meet the lot of 'em—3½, 7½, 14, and 28—at your McCulloch outboard dealer. For free color catalog, write: McCulloch of Canada, 25 McCulloch Ave., Toronto, Ontario, Canada. In the U.S., write to the address below. Dept. P0-6.

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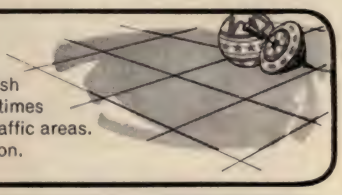

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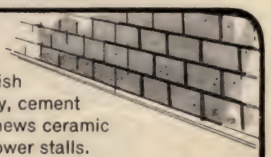

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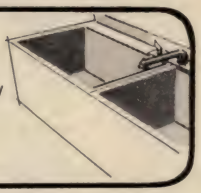

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Modern Rope Lore

(Continued from page 136)

hitch back on the line with synthetics.

A third useful knot is the figure eight. Use it whenever you want to enlarge the end of the line and keep it from slipping through something. One extra turn beyond the simple knot and you have it made.

The granny has been so much damned, and its legitimate brother, the square knot, so much praised, that many people tend to look on it as an almost universal knot. Certainly it has endless uses ashore. On a box or as a reef knot around a boom, where it is supported or lies against something, the square knot is fine. Afloat, where it is used to join two pieces of line without support, it frequently slips. Use two bowlines for joining synthetic lines instead of a square knot.

SPLICES. The only trouble with knots—even those that hold—is that they take so much strength out of the line. Most reduce the breaking strain of any rope by about 50 percent. To avoid this, sailors use a splice. The loss of strength of a splice is a mere 5-10 percent.

Diamond braid polyethylene is the simplest to splice, since it merely calls for the end to be placed in the hollow center, then pulled up tight. Always sew a poly splice to keep it from slipping. Nylon and dacron braid are only slightly more difficult to splice, since you merely work the core into the cover, the cover into the core.

Nylon and dacron twisted lines are very soft and tend to unlay when you start to splice. To prevent this, stopper the strands by taping the line about six inches from the end. Then unlay just one strand, hold a match to it until it fires up and with a wet rag, wipe it as you would a solder joint. This gives the strand a chisel point to penetrate the standing part.

Due to their slippery nature, synthetics should have five or six tucks, and the splice should be finished with a tight whipping to prevent slipping.

CARE OF SYNTHETICS. In addition to protection against prolonged chafing, keep your line out of contact with rusting iron or steel. Rust stains on a line are a warning that a low strength area may exist.

Sunlight also has an adverse effect on any line and should be avoided for prolonged periods. White nylon and dacron can be cleaned with mild soap or detergent and lukewarm water. But don't use a bleach.

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Is a Clean Car Worth More?

(Continued from page 160)

job, with a buffing pad in a medium-speed electric drill.

It's still expensive and might be a little tough getting since, as was explained, the cleaner is intended for use by dealers. However, at $5 a can, there's little reason why the dealer cannot get it for you on special order. Part number of the cleaner, so you can make sure you get the right thing, is 982006.

OK, what's left? Cleaning the exterior. You've probably done this job many times, so we won't labor the point. But here are some tips for a better job:

- Never wipe dust and dirt from a dry car finish—you could scratch the finish.
- Use a mild detergent as a washing agent. These have proved to be the best—certainly as good as most car washers packaged for sale.
- Never wash the car in the direct rays of the sun or if the finish is hot.
- Use a separate soft brush or sponge to clean wheels and under parts of the car. Don't use this same "helper" for the finish. The dirt it picks up could scratch the finish.
- If the finish is dull, consult a dealer who sells your brand of car to determine the recommended polish to use for the type of paint.
- Clean the chrome with a good chrome polish. A light coat of household oil will add extra protection against the rusting and pitting effects of dirt, salt air and, in the winter, road salt.

Moisture Under the Mat

Hold it a minute. You're not done yet. Haven't you forgotten to look in the trunk? Here, you not only have a cleanliness problem, but you could have a maintenance problem as well.

If you're in the habit of lugging bags of dirt, concrete, salt, peat moss or what have you in the trunk, it just might be that this stuff has leaked out and dribbled underneath the trunk mat. It picks up moisture and holds it—moisture that could begin to rot out metal parts. And you can't even see it until it's too late.

So, pick up the mat and give that trunk a good vacuuming, paying particular attention to edges and rims.

Your rewards for your labor don't end with the surge of pride you get when you step back and admire that gleaming "new" car. Wait till you slide behind the wheel. Doesn't it seem to run smoother than it has for months? And when you get ready to trade the car in, you'll find that care and cleaning can *really pay off.* ★★★

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Valvoline Motor Oil with miracle Chemaloy actually cleans your engine as you drive! And keeps it clean. Because bearings, piston rings, valves and other vital engine parts are kept clean, your engine resists wear . . . delivers top power. So change to Valvoline with miracle Chemaloy. Enjoy longer engine life, savings on gas and repairs. Ask for Valvoline—symbol of quality since 1866—at service stations, garages, new car dealers.

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Owners Report—Dodge Dart

(Continued from page 108)

"There are rust spots on the entire car."—New Jersey polisher.

Paint isn't even skin deep these days; surely automakers could add a couple of extra spray booths without running costs out of line.

"I think 15-inch wheels would be better."—Georgia technician.

You can have them as options if you need the clearance and prefer them. The ride is about the same.

"I would rather have larger tires."—Florida carpenter.

"The sharp bend at the gas fill neck makes gas gush back during fill."—Oklahoma designer.

"Gas spills out of the filler pipe and stains the paint. It's very annoying especially since I put up with this with my '61 Rambler for 3 years."—California salesman.

Like the salesman, we are waiting for wider and/or taller, and hence splashless filler necks.

"The speedometer makes a terrible noise."—Nevada claims examiner.

Among the pleasing characteristics of Rambler Americans, here are numbers 11 through 16:

"My Rambler has a tight body with no rattles."—Missouri salesman.

"The sturdiness of the car appealed to me."—New York dietitian.

PM's test American had solid, quiet body, but suspension thudded on all but smooth roads.

"I get a lot of performance out of my car and like the way it handles."—Florida carpenter.

"The new brake system decided me on Rambler."—California salesman.

"The brakes are terrific."—California housewife.

"The quality of this car surprised me. My '63 showed signs of poor workmanship—minor things. The '64 showed excellent workmanship. Quality control has improved 100 percent."—Pennsylvania student.

"More car for my money than the other compacts."—Maryland plastic worker.

"Easy starting in cold weather is important to me."—Pennsylvania inspector.

And us.

"The car starts well in cold weather."—Michigan office manager.

(Please turn to page 200)

Wooden pool-side decks are economical, easy to build, and lovely to look at, but . . .

Every time someone climbs out of the pool, the wooden deck gets another dousing. And what about rain and baking sun? What about snow, ice, and freezing weather?

What's the best protection for a pool-side deck made of wood?

Patiolife(™)

Patiolife is a water repellent sealer-finisher that gives a satin redwood beauty to all outdoor wood – decking, furniture, flower boxes. Patiolife is easy to apply, provides excellent control of chalky rub-off, and will not blister or peel.

P.A.R.(™)

For shingles, sidings, fences, trim use P.A.R., the water repellent finish. P.A.R. comes in clear and in 4 handsome colors that let the wood's grain show through.

These Weldwood® Finishes penetrate the wood fibers, seal out damaging moisture, guard against scaling, checking, warping, discoloration. Actually prolong the life of wood. They cost less, last longer, protect better than paint. And they're easier to use. At leading hardware, paint, lumber dealers.

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the only pipe wrench with jaw opening parallel to lightweight aluminum handle!

Lightweight aluminum handle gives this new RIDGAL Wrench such easy-to-use balance that one-hand operation is no trick at all. Parallel jaw opening speeds those tiring overhead and close-quarter jobs. While light, these RIDGAL Wrenches are so strong that they exceed government, heavy-duty requirements. They're just as strong as regular RIDGID Wrenches of the same size. Housings carry the familiar RIDGID Guarantee not to break or warp.

Spring positioned hook jaw gives positive grip . . . assures fast release, will-not-lock. Both the full-floating hook jaw and the replaceable heel jaw are made of strong, alloy tool-steel, then hardened. Hook jaw design gives easy entry in tight spots . . . without loss in strength. Adjusting nut turns easily for fast, one-hand size adjustment. You'll also like the comfort-grip handle.

See and try a RIDGAL Wrench at your Dealer's. For your convenience, he carries a complete stock of RIDGID Work-Saver Tools.

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Patent Applied For

Owners Report—Rambler

(Continued from page 198)

To wind up owner complaints, here are numbers 11 through 16:

"Rear view mirror creates a dead spot in the windshield."—New Jersey technician.

Next year let's see Rambler spend $1 more for a vertically adjustable mirror to please all of the drivers all of the time.

"Rear-view mirror is too low."—Washington salesman.

"The doors do not fit well and the trim is not well fastened."—Oklahoma professor.

"Mechanical trouble on my Rambler is a very touchy accelerator."—New Jersey bus greaser.

"The car has very sorry accelerator linkage."—Florida salesman.

Accelerator on PM's test car stuck at engine linkage at about half throttle. Oiling liberally remedied problem temporarily at least.

"Lack of a horn ring is awkward."—Oklahoma teacher.

"It's a little sluggish at low speed when I'm trying to pass."—New York sales manager.

"Not as fast on the getaway as my 1960 Rambler American but has a lot of pep after it gets moving."—New York mailman.

"Doors are hard to close."—New York filter and kiln operator.

There you have it—the evaluations of the new Rambler American by those who know it best, owners who had driven their new cars an average of 3806 miles. ★★★

Honeycomb Uncapper

Beekeepers can now uncap honeycombs with a machine that works twice as fast and at half the cost of manual uncapping.

A standard 17-inch honeycomb is passed between two aluminum rollers, each studded with 32,000 metal teeth. Heated to 120° F., the rollers uncap both sides of the comb and produce wax-free honey, thus eliminating the extra step of sifting out wax as required in manual uncapping.

A second set of rollers is available to roughen the emptied comb, since bees will not reuse a comb if the wax is smooth.

Invented and patented by Charles D. Owens of the U.S. Department of Agriculture, the machine can be made by application for a license to: Administrative Services Division, Agricultural Research Service, U.S. Department of Agriculture, Washington 25, D.C.

Richard Petty's Plymouth—with silvery-plated Champions—sets a record of 154.334 mph in Daytona "500"

The overwhelming majority of major race winners use Champion spark plugs because Champions have no equal for performance. Why settle for less in your car?

To feel new power in your car, instantly, install new Champions now and every 10,000 miles

DEPENDABLE CHAMPION SPARK PLUGS

I'll Set a New World's Record

(Continued from page 96)

that holds the world record and one that will hold it within a few weeks. To date, there is $78,000 in *Wingfoot*.

With financial backing in hand, Walt built the frame and mounted the engine. I built the body. That bare sentence tells nothing of the long hours of work involved, but at last the car was finished.

The Crash That Spelled Success

Until this article appears, few people have known that *Wingfoot* once crashed at a speed of more than 250 m.p.h. and survived. Strangely, the accident confirmed our faith in her design. Here's what happened:

Not long after she was built, Walt took her to a drag strip in the Middle West to test her. The driver aimed her down the strip, wound her up, and *within a quarter of a mile hit 250 m.p.h.*, exactly as my calculations showed she'd do. At that speed he hit the parachute release. Both 'chutes shredded. *Wingfoot* whistled over the end of the strip, knifed through a chain-link fence at 200 m.p.h., ripped across a highway, jumped two four-foot ditches and plunged 75 feet into a wooded area. Only the 300 feet of fence that had become entangled in her rear wheels stopped her. But when she halted, she was headed straight as an arrow in the original direction. The driver climbed out without a scratch, for which we were thankful.

It was a tragedy though. When Walt saw the *Wingfoot* possibly headed for oblivion he had a heart attack on the spot. (He still refuses to look at any photos of the accident.)

Our reserved date on the salt flats was only one month away. Against orders, Walt climbed out of his hospital bed and began rebuilding the frame. I cut loose the front end, strapped it to the top of my station wagon and drove it home to Wheaton, Ill. There, working nights and week ends, I managed to give it a new skin. We made our three-day reserved date at Bonneville.

On the salt flats we faced another problem. Walt had been planning to drive when we made our assault on the record, but obviously he couldn't take the risk after his heart attack, and in addition he severed a ligament in his hand while rebuilding the frame. Walt decided that I should drive because I knew the car.

Until that moment I had never driven

(Please turn to page 204)

NOW MAKE BATHROOM REPAIRS THAT REFUSE TO WEAR OUT

—with an amazing, virtually indestructible new sealer and glue that's as easy to use as toothpaste

Amazing new SILASTIC® brand Bathtub Caulk won't crack, chip, shrink, crumble, dry out or wear out—for years! Just squeeze it on and it dries into an elastic seal of silicone rubber. Use it to seal cracks between tub and tile, tub and floor, washbasin and tile. Or use it to glue on towel racks, soap dishes, loose tiles—even glass doorknobs. Every home should have a tube handy. At all hardware and paint supply dealers—U. S. and Canada.

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That steering wheel can tell you a lot! *Your Chevy's steering wheel is sort of like a country telephone party line. If something's going on, it gets the word fast. And passes it on to you. So if you should notice a little steering wheel shimmy, pay attention to it. It may mean that your car's front end needs a checkup. If any parts are needed, ask for Genuine Chevrolet Parts. You see, these are designed especially for your Chevrolet. To fit right and stay right for a long time. Easy to find, too. Chevrolet dealers and leading independent garages and service stations across the country have access to more than 80,000 others. Just ask for them by name . . . Genuine Chevrolet Parts. . . . Chevrolet Division of General Motors, Detroit, Michigan.* ***It pays to keep your Chevy the Chevy-est.***

GM
CHEVROLET
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Look for this sign.

I'll Set a New World's Record

(Continued from page 202)

a car more than 130 m.p.h. To get acquainted with the feel of *Wingfoot*'s controls, I cruised back and forth across the section of the flats known as the parking area. She was a dream.

By the time it was our turn on the black stripe, we had our plan. We would start at 230 m.p.h. and increase succeeding runs in increments of 20 to 30 m.p.h. until we had beaten John Cobb's 16-year-old record of 394.19 m.p.h. Then we would quit.

For a time, everything went as planned. My first run hit 236 m.p.h., and I was glad that we had started at a fairly low speed. Each succeeding run taught me something. For example, I hadn't fully anticipated that I'd have the feeling of rattling and banging down that black line like a rock in a tin can (the salt was a little rough).

I also found that at 250 m.p.h. the upholstery in the seat hugged me like a pressurized suit. It didn't matter, but it might have been unnerving at a higher initial speed. At 275 m.p.h. I had the weird feeling it was snowing in the cockpit. Actually it was salt crystals seeping in.

These runs also taught me that I could easily steer with one hand, leaving the other free to operate the power and parachute levers. I never drifted more than eight feet off the black line, and that one time I wandered slightly because of my attention to the airspeed indicator.

In the 300-m.p.h. run I used the afterburner. When I cut it off I had the distinct impression that I had slammed on the brakes, but the airspeed indicator showed that I was still accelerating under regular engine power.

Wind resistance is the major factor in stopping the car at the end of the run. Some race fans have the erroneous impression that the length of the salt flats is the determining factor in attainable speeds because there is not enough room to accelerate a car to its maximum speed, whip it through the one-mile trap, then stop it before it runs out of stopping room. Someday that may be true, but not yet.

Rule Needs Changing

First, the rules require that the one-mile timing trap be set up *in the middle of the course*. In my opinion this rule should be changed, but we can live with it as well as the others. Most jet cars accelerate so fast that it would be safer if the trap could be set up within two miles of the beginning of the black stripe, giv-

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Much more than just a yellow-colored blade! Clad in super-tough Mylar*. Lasts up to 10 times longer. Resists abrasion, dirt, oils and most solvents. Easier reading, too.

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STANLEY TOOLS have been selected for the

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THE STANLEY WORKS

ing that much more room to stop the car at the other end. *Wingfoot* will accelerate to over 400 m.p.h. in one mile. One additional mile will bring her only to 480. At that point we might as well cut the engine.

However, the rules deny the option of moving the trap. Okay. For the sake of illustration, let's assume the worst, and say that when *Wingfoot* makes her runs in July the course, normally 11 miles long, will be only nine miles because of mushy or rough salt on some parts of the lake bed. This means I'll have four miles to hit record-breaking speed (much more than *Wingfoot* needs), one mile in the trap, then four miles to stop.

Wingfoot has a deceleration rate of 100 m.p.h. per mile, mostly from wind resistance. Thus if I leave the trap at a speed of 450 m.p.h., I'll be slowed to 150 m.p.h. at the end of the black line without even touching the brakes. In addition to excellent brakes, I have two chutes I can pop. I have no worries about stopping *Wingfoot* in time.

During last summer's runs we were elated with *Wingfoot*'s performance as we built up speed. Then, after our 335 m.p.h. run, only about 59 m.p.h. short of the record at that time, we ran into trouble. The next run was inexplicably slower. We soon learned why. Salt crystals kicked up by the front wheels had found their way to the jet intake and formed hard deposits on the rotor blades, throwing the engine out of balance. We tried unsuccessfully to clean them off. Ordinary table salt had thwarted us. We left the flats to make way for Breedlove.

We were disappointed. But our runs confirmed beyond any doubt that *Wingfoot* can beat the record. To reach 335 m.p.h., which was our fastest speed even though it was not made through the trap, I had applied *only 30 percent power, and hadn't even used the afterburner.*

Last winter, I installed some fairing to prevent salt from seeping into the engine. I also built a wind tunnel in my garage, and exposed a detailed model of *Wingfoot* to exhaustive tests. I *know* she's right.

We'll be out there on the salt in July. At this moment I won't predict what the new world's record will be; very likely we won't push *Wingfoot* to her limit. But I'm confident we'll break Breedlove's record. *Wingfoot* will prove that she's the fastest car ever built.

Editor's note: If the *Wingfoot Express* sets a new world's record, you'll read Tom Green's first-person account of the assault in an early issue. ★★★

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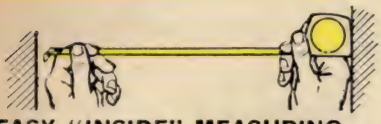

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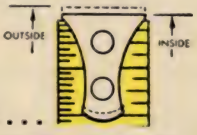

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Floating Slingshots

(Continued from page 88)

ever been in. But the end result is ingenious. Two long cylinders contain the high-pressure steam which propels the shuttle, or horsecollar, down the track. The horsecollar—I call it that because the cable they throw over it is called the bridle—is the only thing that shows above deck. It's attached below deck, and between the cylinders, to what might be described as paddle-like pistons that fit snugly inside each cylinder. The steam acts against the paddles. Obviously, however, there are slots the length of the cylinders where the paddles attach to the horsecollar.

How can they keep high-pressure steam in cylinders with slots in them? That's the ingenious part. A thin pliable strip of metal runs the inside length of each cylinder, and is held against the slot by the steam pressure. As a paddle moves down the slot, flanges at its base slide under the metal strip, lifting it momentarily as the paddle slams down the track. Steam pressure slaps the strips back against the slot right after a paddle has passed.

My first flight with Commander Jones consisted of two catapult take-offs, three "touch-and-go" landings and one full-stop landing.

Arm Signals Instead of Chatter

Radio channels are limited to talk between the control tower (in the superstructure), the pilots and the LSO. So the waving of arms and hands becomes the only communication for getting those million-dollar aircraft across the deck safely and into the air every 30 seconds.

All launches start at the catapult, where each plane is cabled down in turn. The rear cable, anchored fast to the deck at one end, is attached to the tailhook by means of a "tension bar" resembling a dumbbell. One round end drops into a socket on the end of the cable; the other fits a socket in the tailhook. The tension bar is designed to break apart at the exact moment the power of the catapult and the power of the plane's own engine are high enough to throw the craft into the air. Faulty launches are rare.

As the green-suited catapult crew swarms around the plane, one man drops the tension bar in place and wig-wags the plane director, who in turn signals the pilot to move the plane forward until the rear cable and its tension bar are taut. The front cable (bridle) is then attached to a thick, crescent-shaped hook under the cockpit and draped over the horsecollar on the deck. Then, while the plane

(Please turn to page 208)

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Floating Slingshots

(Continued from page 206)

stands fast, the crew wig-wags the catapult operator to inch the horsecollar forward until *that* cable is tensed up. About this time the plane director has two fingers in the air and the engine is starting to roar. The crew makes a final check, one man actually bouncing his weight on the bridle. Then they all scramble for cover as the director's left arm goes down.

That signals the catapult operator, at the starboard edge of the deck, to punch the "go" button. Catapult power goes on full, and it's the moment of truth.

There is a power-laden roar as the jet's engine and the catapult build in unison. Then the tension bar parts. Horsecollar, bridle and jet blast down the track together. The horsecollar slams to a stop in a water bath, buried beneath the deck at the track's end. As the plane whooshes over it, the bridle slips off the hook and the plane rides free, carrying half of the tension bar snug in its nest in the tailhook.

All of this takes less than 30 seconds.

The momentary wobble as the jet leaves the deck is due to the fact that the catapult was actually propelling the plane faster than its own engine. A standard Navy boast is that the catapult has enough power to throw a 1964 Cadillac more than 3000 feet in the air—straight up. I believe it. I could feel the slowdown when the bridle dropped off the hook.

The flight around the pattern was further from the ship than I thought it would be (World War II newsreels, I guess). Then, Jones turned in for the approach. World War II carrier pilots tell me the approach then was much shorter and almost a continuous turn. We started miles from the ship and came straight in. The letdown, I learned, was about a four-degree angle.

Meatball Means You're Fine

I could see the meatball almost immediately. *Lexington* pilots said that, if you're at the right altitude and the right distance from the carrier, it's almost impossible to miss it.

Keeping it there is the problem. The closer in you get, the narrower the range; but the bigger the deck looks. So, pilots begin switching their focus from the meatball to the deck, favoring the deck more as they come closer. But the meatball gets them there.

A layman might think the pilot would cut his engine back when the wheels hit the deck, but this is suicide in a jet. If the hook misses, the plane would never regain

(Please turn to page 210)

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The Los Angeles to New York Mobil Economy Run proved one thing for sure. There's quite a difference in the transmissions of new cars.

Three out of four for Buick

The long-time champion in the transmission league—Buick—walked off with the 1964 economy pennant. No other single make of car won as many events as Buick. Four entries, three winners.

The winning Special carried the new Super Turbine 300 automatic transmission; the LeSabre was equipped with the Super Turbine 400 (both optional at extra cost). They're the latest in a long line of Buick transmissions well known for their smoothness and absence of "shift feel". The Super Turbine is a refined and improved torque converter type to help you safely pass cars and trucks as well as gas stations.

You'll hear a lot about it in the next couple of years as this modern kind of transmission is adopted by more and more car builders.

What about engines?

Of course, an efficient transmission gets more efficient when teamed up with a lean, agile engine. The winning Buick power plants were our new V-6 and V-8. The 300 cubic inch V-8 in the winning Buick Special (the lowest priced of all Buicks) and the Buick LeSabre (the lowest priced big Buick) is like a well-conditioned fighter. All muscle, no fat. Weighs in at far less than other V-8's of similar punch. It took every other V-8 in the Economy Run.

Your type of driving—regular gas

The Run was through cities and towns, across super highways, in traffic, out of traffic. This was not race track driving or proving ground driving. This was your kind of driving—even though you can't expect to get as good mileage as these expert drivers in their finely tuned production cars. The distance was 3,243 miles, about what most families log in four months. All three Buicks used regular gas.

So the Economy Run is not just a cross country tour for the Mobil people and a few car buffs. It's a reliable test of a car's power team and what it's able to squeeze out of its fuel.

We don't expect everybody to rush out this week-end to buy a new Buick just because we won a few economy trophies.

There are so many other good reasons for leaning to Buick that economy usually gets second billing. There's styling, naturally. An unusually great ride. Extraordinary engineering and workmanship. And very young performance. Small wonder Buick sales are running at 11.5% over last year.

But it's nice to get economy as a plus in a Buick. Beyond the dollars saved on gasoline, there's a certain pride in knowing you have a car that's built to get the most out of every tank of gasoline.

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Floating Slingshots

(Continued from page 208)

flying speed before it went over the edge. So, when the wheels hit, the throttle is jammed full forward. If the hook catches, *then* cut; if not, you're ready to fly again.

When they explained this the day before, it worried me. How does a pilot know when he's really hooked? Supposing he reduced throttle, thinking he's been hooked but wasn't? Well, I found out.

No Question, You're Hooked

It's like this. As our wheels hit, Jones rammed the throttle forward just as he had done three times before on touch-and-go approaches. Then, "WHOOMFFPH!" I was jammed forward against the shoulder harness. I lost just about all the air I had in my lungs, and my bloody eyeballs nearly popped out and rolled down the deck. Buddy boys, when you're hooked on a carrier, you just *know* it. So forget it!

I was too shook up to notice the "hook runner." He's the man with the most dangerous job in the Navy. He stands at the edge of the deck, and should wait until the plane stops dead. But, watching the landings the day before, I noticed he almost invariably dashed out when the plane's wheels hit the deck. If the cable snapped—and they have at times—it could tear him in two. But most of them are just young kids, and they have their own cocky pride, so they keep dashing out. If planes aren't down and ready every 30 seconds, it won't be their fault.

There's much more activity on, below and above deck, than we have room for here. Men in checkered clothing check the planes for damage and flyability after landings and before take-off, making sure the landing gear and tires are intact, hooks secure, bombs or wing tanks on snugly. Men in red are the refueling and ordnance crews and, if necessary, firefighters. Men in white are medics, and men in asbestos suits have just one job—rescuing pilots from burning aircraft.

Then, there are the helicopter crews who patrol the skies near the carrier during all operations. They are the first off and the last down, and their job is to pull pilots from the sea in case of crashes. Just before my first catapult, with all I had on my mind, one flew into view off the right side of the carrier. All I could think was, "What's he looking at *me* for?"

Well, he looks at all of them, and it's a shame everyone else in America couldn't do the same. The sights, the sounds and the violence of U.S. carrier operations are truly something to behold—and to be proud of. ★★★

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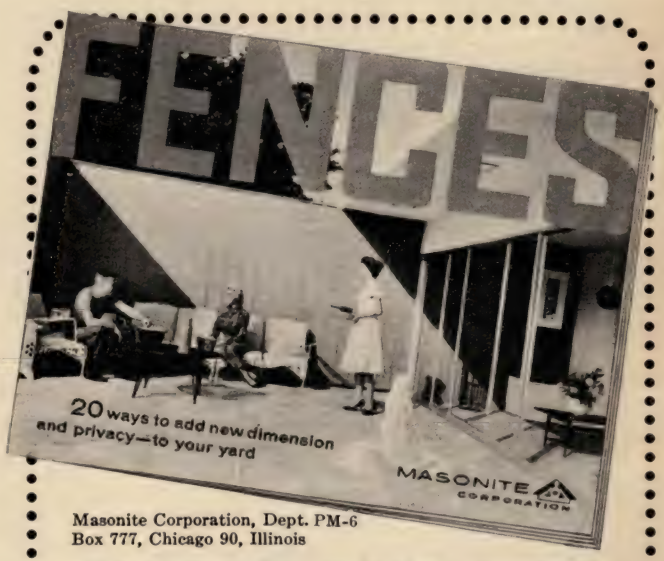

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Moon Power for Paris Lights

(Continued from 77)

manent dam. With the two-way tides, the job had to be done at water levels with a difference of as much as 44 feet. It was necessary to swing two curved walls below and above the future dam site. To wall off the lake on the downstream side while the huge tides rolled in and out, the engineers in effect created a picket fence of giant posts and then filled in the gaps between the posts.

From Balloons to Dams

"Posts" of the type needed to stand the unique strains involved had never been built in the entire history of hydraulic engineering. The problem was turned over to one of the world's most distinguished engineers, Albert Caquot, whose many accomplishments include the design of the balloon system used for artillery reconnaissance during World War I. At nearly 83, Caquot is administrator of the state-owned *Electricité de France.*

The plans based on Caquot's design, called for the construction in St. Malo Harbor of 19 prefabricated reinforced concrete cylinders 30 feet in diameter and 64 to 85 feet long. With their ends stopped up to make them float, the cylinders were towed to the site. Workers in an air-pressurized chamber had prepared concrete underwater bases to receive them. Frogmen went down and threaded cables through prepared slots and hooked them to the floating hollow posts.

Power winches on boats turned each cylinder slowly upright on its base, while it was filled with water to keep it standing. Then thousands of tons of sand were poured into the cylinders to displace the water, and the curved formation of sturdy pillars occupied the center of the river. After that, the gaps between them were closed, one by one, by an ingenious arrangement of vertical concrete slabs fittings into slots on the exterior of the pillars, and by sand-filled metal cylinders built around the slabs.

Easier Upstream

Now that the tides were stemmed, building the upstream wall was easier. An oval central area was finally enclosed last October 24th. It then took six weeks to empty the lake's 260,000,000-odd gallons, thus presenting the engineers with a dry river bed—an island below the water line —on which to build the permanent dam containing the electric power plant. Until the project is finished late in 1966, the Rance waters will remain practically closed in, and the tides won't be felt above the dam. The sluice gates will be opened from time to time to pass the tides up and down to clean the estuary's waters.

Damming the Rance was one job. Designing new hydroelectric power machines to convert the river's double punch into kilowatts efficiently and economically presented a quite different and equally demanding challenge. To fit this special job, six manufacturing firms—five French, one Swiss—combined to produce an enclosed hydroelectric power unit which looks like a pot-bellied submarine about 40 feet long, with a giant propellerlike turbine protruding from one end. This turbine is reversible, and both incoming and outgoing tides will spin it, driving an electric generator inside the "sub." This ingenious unit has a capacity of 10,000 kilowatts—enough to supply the electrical needs of about 15,000 people.

Twenty-four of these power units will be mounted in apertures in the central part of the dam, each with a vertical shaft through which workmen can descend to perform maintenance jobs. In building these "power pods," special alloys had to be developed to resist the corrosion of sea water. In a subterranean cavern below the St. Malo harbor level, tidal water has been operating one of these units for more than four years, and it has been started, stopped and reversed hundreds of times to test all of its components under actual operating conditions.

Synchronized Time and Tide

Because the implacable rise and fall of the tides is the result of gravitational pull of the moon and sun on sea water, one of the limitations of previous tidal power schemes has been their dependence upon the schedule of the moon, which does not always coincide with man's needs for electricity. After a long study of seasonal and daily tidal variations, the French engineers have devised flexible methods of operating the dam so that the power curves of the lunar rhythm fit the hourly needs of an industrialized world.

There are many ways of exploiting the constantly changing difference in water levels above and below the dam in order to squeeze out the maximum of power during the periods when it is most needed. Many strong tides will perform double service, spinning the turbine blades as they surge through to fill the reservoir, and turning them again as the water pours out after the tide recedes. At other times it may be more efficient to open the sluice gates and let the reservoir fill itself, making power only as the water pours out. Still another method will be to operate the

(Please turn to page 214)

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Moon Power for Paris Lights

(Continued from 212)

reversible turbines as pumps, investing electric power to over-fill the reservoir during slack power periods at night, and collecting a dividend by releasing it to run the generators at low tide in peak hours. (If you lift a weight one foot and drop it ten feet, you make a power profit.) Engineers have drawn up elaborate charts in which these various methods of operation are coordinated with tidal rhythms and power needs, making it possible to plan the most profitable use of the plant for months ahead. When the plant is completed, its generators will turn out power on the average of six hours a day.

This steady year-round production is especially important to France. Dammed rivers now supply nearly half of France's electricity, but there are about 100 days in winter when low rainfall reduces many streams to a trickle and water power is drastically curtailed. During these periods, expensive coal is now burned to make up the deficit. The tides in the Rance, independent of rainfall fluctuations, will provide badly-needed kilowatts during these annual droughts.

The St. Malo tidal dam is a good example of an invention, sound in principle, which had to wait until the time was ripe for its realization. When it was proposed in 1905 it was impossible to send electric power over wires more than 75 miles without prohibitive losses. Now, by means of three 225,000-volt transmission lines, tidal power will be available to all of France, with a lion's share going to the Paris area, where expanding industry and housing and the market for new devices have sharply spurred the demand for added kilowatts, and to Brittany. A transmission line will bring more power toward Paris, another toward Brest and a third toward the industrial city of Reunes. St. Malo hotel keepers are also cheered by the influx of technical men from all over the world who come to look at the new marvel.

Less Brine in the Briny

As with every new water power development, there is some grumbling. The water above the dam has already become less salty since the coffer dams strangled the flowing tide and increased the content of fresh river water, so commercial fishermen along the banks find fewer plaice and mullet in their seines, and more carp. Pleasure craft repair yards along the shore might have been affected, for with the lower water levels their drydocks would become landlocked. In atonement,

(Please turn to page 216)

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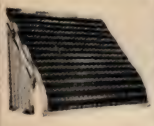

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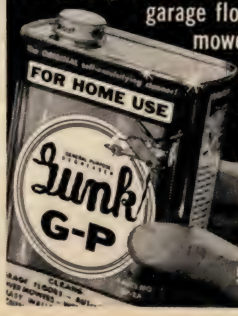

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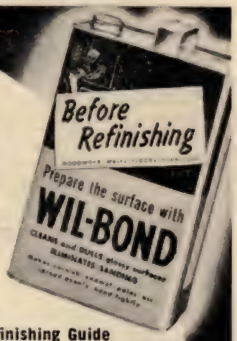

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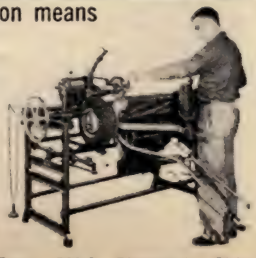

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Moon Power for Paris Lights

(Continued from 214)

the French electricity bureau installed short rail lines free of charge to move boats from the new shores to the docks. A temporary water pollution problem has also been created. Refuse from Dinan and the river villages was once carried out promptly by the tides. Since the river level is now stabilized until the completion of the dam, the gates are opened every two weeks to drain off polluted water and replace it with fresh sea water. And the Bretons are planning to build a modern sewage-disposal plant for Dinan to keep the river clean.

Power engineers throughout the world are studying the St. Malo project. In all industrialized countries, demands for electricity double every decade, and no method of producing it can be neglected. M. Gibrat has drawn up a list of about 90 coastal sites throughout the world where tides are high enough to deserve study. He considers the Canadian project in the Bay of Fundy a most feasible one. He believes that the much-debated Passamaquoddy project on the Maine-New Brunswick border is a practical possibility, provided Canada and the United States cooperate in its construction. He is especially interested in a site in northwestern Australia, where tidal power might lead to a great industrial development. He cites a study made by French engineers at San José, Argentina, where the tides might be harnessed by digging a canal between two bays, and mentions the mouth of the Seoul River in Korea as another technically feasible site. Dozens of other proposals have been made, among them blasting artificial basins to entrap water at high tide which can be released to run turbines. He regards France, however, as the most favorably placed country in the world for tidal power.

More Tidal Giants for Tomorrow

"The next great possibility," he says, "is to dam the great bay at Mont Saint Michel, where the celebrated high tides for centuries played a role in the defense of the island fortress. It will be another 20 years before such a giant plant can be economically integrated in the French power network, and it will take ten years to construct. It would be a tremendous source of electricity."

An old concept likens the moon to a great circling bird which brushes the seas with its wingtips and piles up its waters. With St. Malo pointing the way, the silver bird may some day bring light to millions. ★★★

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There may be arguments about **how** to fish or what to fish **for**, but everyone who's ever fished with Berkley's Trilene Monofilament agrees it's the best to fish **with**. Push button or open face spin casting, bait casting, or trolling in fresh or salt water, Trilene behaves better on **any** reel. It's softer, with controlled limpness, and more uniform with a smaller diameter for its strength. You depend upon Trilene to deal fish fits — It's a real reel friend.

Berkley Trilene

FREE: send my sample of Trilene.

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How to install ceiling tile quickly, easily, inexpensively.

A simplified step-by-step method for creating new beauty and quiet in any room in your home. Presented by The Flintkote Company, manufacturer of America's Broadest Line of Building Products.

FLINTKOTE®

YOUR NEW CEILING

FLINTKOTE®

Planning the Layout

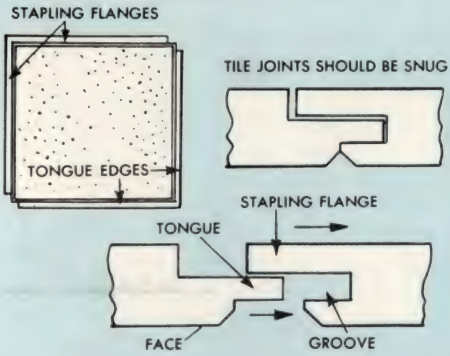
YOU PROBABLY KNOW the "whys" of ceiling tile — beauty, sound absorbency, low cost and easy maintenance — but do you know how simple it is to install a decorative new FLINTKOTE tile ceiling *yourself?*

UNPACK TILE at least 24 hrs. prior to installation to allow adjustment to room temperature and humidity

Only a few common tools are required: a fine-toothed saw for cutting the border tile; a coping saw for making cutouts or notches to fit around light fixtures, etc.; a steel square; a hammer; a chalkline and a staple gun, which can usually be borrowed or rented from your tile dealer. You may substitute a fiberboard knife for the two saws, but make sure that it has a very sharp edge.

Whether you staple the tile to furring or mount it directly over the old surface with adhesive, will depend on the condition of the existing ceiling. Solid level plaster which doesn't give under pressure and isn't cracked makes a firm enough base for adhesive installation. A gypsum wallboard ceiling in good condition makes an equally good base, provided it's at least ⅜ in. thick and nailed on centers not more than 16 in. apart (½" gypsum wallboard will allow 24" on center nailing). However, if the ceiling is badly cracked, loose or has a rough surface texture, you should install 1 x 3 furring strips, nailing through the old ceiling into the joists. Tile is then stapled to the furring.

SLIDE TILE INTO POSITION TO MAKE SNUG JOINT; DON'T FORCE OR HAMMER TILE INTO PLACE

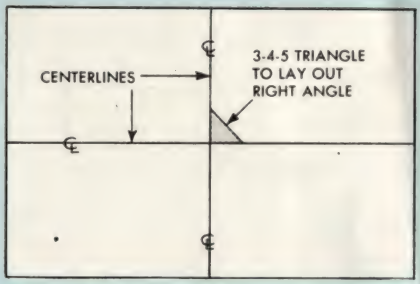


MATERIALS FOR EACH 100 SQ. FT.

TILE SIZE	12" x 12"	12" x 24"
½" OR 9/16" STAPLES OR 1⅛" BLUED LATH NAILS*	400	300
8D NAILS FOR FURRING	1.7 LBS.	1.7 LBS.
1" x 3" LATH (LINEAL FT.)	140	140
CARTONS OF TILE	1.7	1.7
COVE MOLDING	PERIMETER OF ROOM PLUS 20%	

*WHERE STAPLES ARE USED, ORDER 50 LATH NAILS FOR FACE-NAILING BORDER

CHALKLINE is simply a cord coated with chalk and stretched between two points. It acts as a straightedge



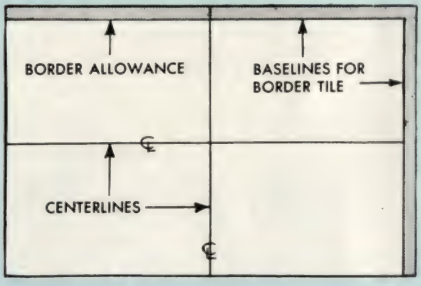
IF ROOM IS perfectly rectangular, you can snap centerlines between midpoints of opposite walls

An alternate furring method, which might be termed "sheet furring," involves the installation of gypsum wallboard over the old ceiling or bare joists. Tile can then be mounted directly on this gypsum surface either with ATLAS Acoustical Tile and Wallboard Cement Adhesive or the Bostitch GYPLOK staple method.

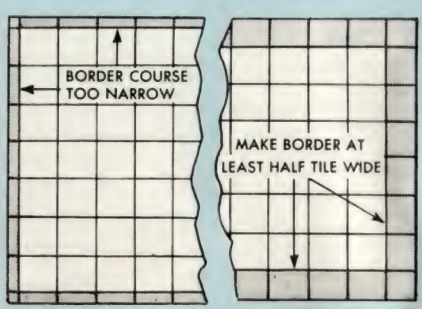
Regardless of which installation method you use, the layout procedure is basically the same. First, measure the two short walls and locate the midpoint of each, then snap a chalkline between these points to establish the lengthwise centerline of the room. In the middle of this line, snap a chalkline at right angles to it to establish the short centerline. All tile will be installed parallel to these lines.

For a pleasing symmetrical appearance, the border courses of tile along opposite walls should be of equal width and no narrower than 6 in. Thus, in a room where the centerline measures 18 ft. 6 in., a course of tile installed along this line would consist of 17 full 12 x 12-in. tile and two end tile trimmed to 9 inches.

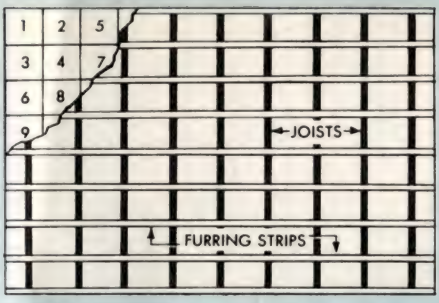
After determining the width of border tile along opposite walls, snap two chalklines parallel to the centerlines to serve as baselines for installing these border courses. Once these baselines have been established, you are ready to begin installing the tile.



TO INSURE baselines being parallel with centerlines, measure out from centerline, not from wall



BORDER COURSES less than half a tile wide look out of balance. Make them at least 6 in. wide



PROPER SEQUENCE of installing tile is noted above. Border tile are always mounted before adjacent full tile

Installation over Furring

WHETHER YOU ARE furring over an existing ceiling or bare joists, the procedure is the same. Remember that furring strips must always be nailed to joists. If you are nailing through plaster or gypsum board, first locate joists by tapping.

The first furring strip should be located either on the centerline or 6 in. to one side, depending on the width of the room. For instance, in a room 12 ft. 6 in. wide, every cross course of tile will consist of 11 full tile and two 9-in. border tile. Since this is an *odd* number of full tile, obviously the middle tile will be centered on the centerline so furring strips should be installed 6 in. on either side of this line. If an *even* number of full tile had been used, then a tile joint would have fallen right on the centerline and your first furring strip would have been installed there.

Work out from the center of the room, installing the rest of the furring strips parallel to the first one on 12-in. centers.

After you have established two intersecting baselines for the border tile, as described on the preceding page, you are ready to begin installing the tile. Start with the corner tile and work out from this corner.

SPACER JIG can be cut and assembled in minutes, assures quick and accurate positioning of strips

CHECK LEVEL frequently with a straightedge, since any depression will show up in finished ceiling

LOW SPOTS can be made level by loosening nails and driving thin shims between joist and furring strip

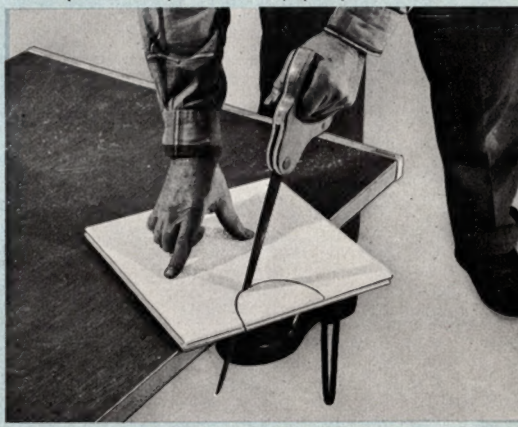
EACH BORDER TILE should be cut to fit. Don't cut them all at one time, since wall may be out of line

WHEN STAPLING TILE to furring strips, be sure that you maintain perfect alignment with adjacent tile

Since all finishing border tile will have the stapling flanges removed, you'll have to face-nail these into the furring strip next to the wall. Be especially careful to locate these nails close enough to the wall so that they will be hidden by the cove molding you plan to use.

After all the tile has been installed, nail cove molding in place to cover the face nailing on border tile. You can avoid getting paint on the tile by painting the molding before you install it, then touching up the heads of the finishing nails with a small brush once it's in place.

MAKING CUTOUTS to fit around light fixtures will be no problem if you make a paper pattern first

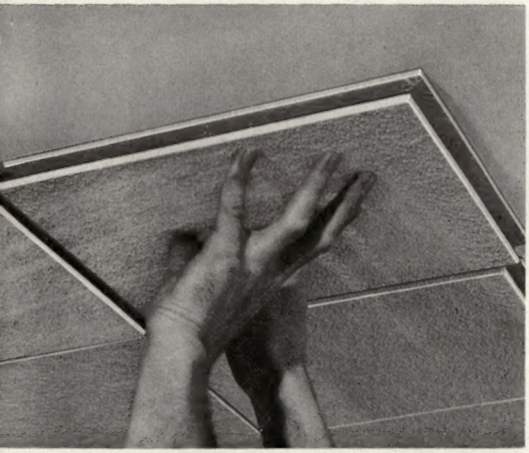


TO CUT TILE with fiberboard knife, score face deeply and break over sharp edge, then trim back of break

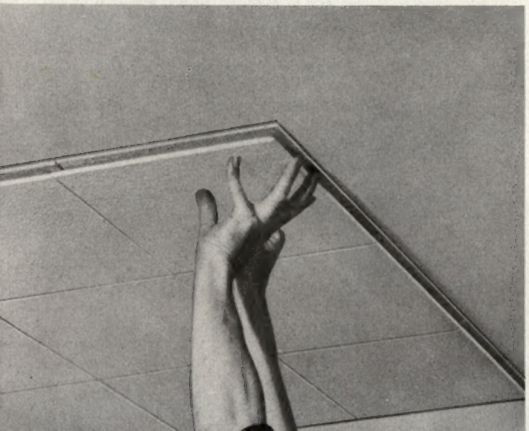
FINISHING TOUCH for new ceiling is provided by cove molding painted or stained to match the wall below

Adhesive Application

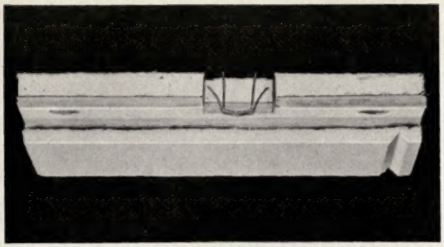
THERE ARE TWO different types of adhesive which may be used to install ceiling tile, but they are basically similar in application. The thick ATLAS Acoustical Tile and Wallboard Cement, shown at left, is applied with a putty knife and requires that a walnut-size daub be placed in each corner about 1½ in. in from either edge. The thinner brush-on type is applied with a paint brush in five 1½-in. daubs—one in each corner, as with acoustical, and one in the center. Make sure that the existing ceiling is perfectly clean, with all paint or paper adhering well, before you begin; then follow the layout and installation procedure as with furring.



INSTALLATION with acoustical and wallboard cement adhesive requires that you place the tile in position, slide it *back* about ½ in., then slide it forward into position. With this type of adhesive, the tile should be pressed only to within ⅛ in. to 3/16 in. of the ceiling, *not* flush against it. When installing tile with a brush-on adhesive, however, simply slip the tile into position and press it tightly against the ceiling. However, in either case it's important that you apply pressure evenly over the whole surface of the tile. Also, remember to slide the tile into position; don't swing it up against the ceiling.



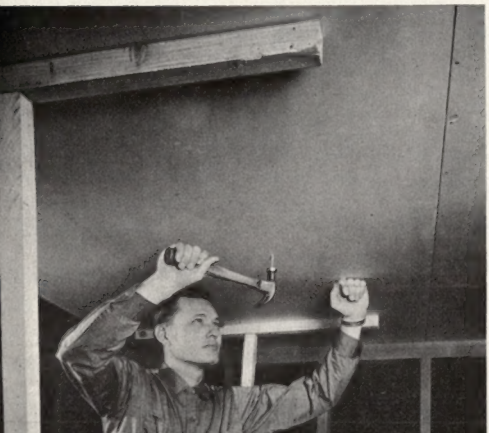
WHILE THE ADHESIVE is strong enough to hold the tile against the ceiling, it is recommended that you add some supplementary nailing or stapling to prevent lateral shifting during installation. Tile installed with brush-on adhesive will be flush against the ceiling, so stapling is the logical fastening method to use in such cases. However, tile installed with acoustical-type adhesive won't be flush to the ceiling, so you may wish to use some small nails in place of staples to guard against lateral movement of tiles already in place. Since the last few tiles of the installation must be swung up into position rather than slid, be particularly careful not to disturb the adjacent tile.



Sheet Furring

PARTICULARLY WELL-SUITED to the installation of a new FLINTKOTE ceiling over bare joists or rafters is the sheet-furring method, mentioned earlier. With the aid of T-braces made by nailing 2 x 2's together, one man can handle sheets of FLINTROCK® Gypsum Wallboard, and it's a fast way of providing a base for installing tile. Also, FLINTROCK increases the ceiling's sound-deadening and fire resistance properties. Follow the manufacturer's instructions closely.

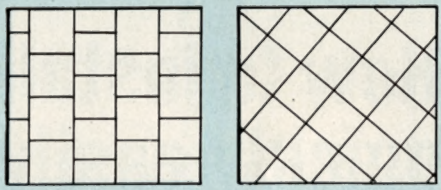
While you can apply the tile with adhesive over this base, you might consider the Bostitch GYPLOK system. This stapling system requires a slightly refined tacker that will allow the driving of a second staple over the first so that it flares out for extra holding power.



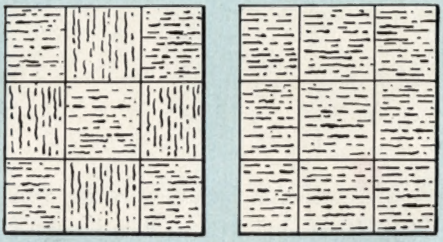
INSTALLATION TIPS

- Since no tile finishes are perfectly uniform, mix the tile from different cartons to assure the best possible blending. Never work out of one carton.
- Be sure that your hands are clean before handling tile. Dust them with talcum to prevent smudges. Spots may be removed from tile with an art gum eraser.
- To assure clean accurate saw cuts, scribe the cutting line with a fiberboard knife before sawing. Use a saw having at least 12 teeth to the inch.
- To conceal pipes, heating ducts, etc., build a box frame of furring strips around them, cover with tile and mask cut edges with outside corner molding.
- To clean tile ceiling, use any mild detergent and a damp (not wet) sponge. Rinse the sponge frequently to avoid dirt building up on it.
- Tile may be painted with any quality oil-base paint without loss of sound-cushioning qualities. Paint one row at a time, following joint lanes.

SPECIAL INSTALLATION PATTERNS



If the room is an irregular shape, you can de-emphasize this by installing tile in a staggered or diagonal pattern. If the tile has a directional surface pattern, you can make the room appear longer by running the pattern lengthwise of the room or wider by running the pattern across. To offset the effect of a directional pattern, alternate the pattern direction as shown below.



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